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China Report

ECONOMIC AFFAIRS

ENERGY: STATUS AND DEVELOPMENT--49

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CONTENTS

NATIONAL POLICY

EXPANDING ENERGY INDUSTRY TO ENSURE QUADRUPLING GOALS

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese No 6, 25 Dec 85 pp 1-6

[Article by Huang Anli [7806 1344 3810], National People's Political Consultative Conference Economic Construction Group: "On the Issue of Expanding the Energy Industry To Ensure Quadrupling of Industrial and Agricultural Output"]

[Text] The energy problem is a matter of overall importance for national economic development. According to the projections of some World Bank specialists and the understanding of some domestic specialists, to quadruple industrial and agricultural output, energy sources must be more than doubled. To adapt the expansion of the energy industry to the demands of quadrupling industrial and agricultural output, beginning today it will be necessary to adopt strong measures in development of coal, petroleum and natural gas exploration, electric power construction, the peaceful use of nuclear energy and the development of renewable energy sources to accelerate the pace of energy industry development.

Establishing Plans for Coal Industry Development Centering on Exploiting Coal Resources

China's coal industry is already rather sizable and has formed a system which consists of the geological exploration, design, scientific research, machine manufacturing, processing and utilization as well as coal education for developing China's coal industry, and a set of principles and methods for breaking new ground in future coal industry expansion.

Over the past few years we have created our own corps of specialists to accelerate the expansion of the coal industry. According to statistical materials, China's known coal reserves are 770 billion tons of a variety of types. In 1984 China's coal output reached 772 million tons, third-place worldwide, and plans are for coal output to reach 1.2 million tons by the year 2000. In view of the situation in the past few years, there are three clear features with regard to expansion of China's coal industry: first, that output is growing rapidly; second, production is balanced; third, production is safe.

However, expansion of the coal industry should suit the great "quadrupling" goal. I think that there are still some problems that urgently need to be resolved. Primarily, they are: creating barriers is not favorable to rational expansion of resources; exploration methods, construction technology, and safety measures are backward; coal processing ability is low and transport is difficult; coal prices are low and enterprises lack the ability for self-renewal; capital is short and construction is difficult; enterprise quality and employee quality is deficient and is not suited to modernization of the coal industry, etc. Since the proportion of coal (70 percent) among non-renewable energy for a considerable time may still increase, solving the problems which exist in coal industry expansion is urgent and critical.

1. Smashing Barriers, Rationally Expanding Coal Resources

The distribution of China's coal resources is extremely uneven. Proven coal reserves are primarily distributed in the north, with only 2 percent in the eight southern provinces, yet it is just the opposite with the proportion of industry, creating the irrational phenomenon that China's energy centers tend to be in the west, while economic centers tend to be in the east. Since the distribution of resources is uneven, development is not balanced. To satisfy the needs of local economic expansion, some old mines in east and northeast China can only be maintained through increasing the intensity of development. Yet the coal resources of some regions have not been exploited because they do not have the development ability. For example, the annual output of the Xuzhou Coal mine is 12 million tons, but the reserves are not great and extraction is limited until 1995 at the most. The reserves in Xuzhou's neighbor, Yuncheng County, Henan, which are several billions of tons, are not developed because they lack the ability. Xuzhou wants to mine this coal but cannot because Yuncheng and Xuzhou are under the separate jurisdictions of Henan and Jiangsu Provinces and it cannot cross the border to develop it. Even if Henan could mine the coal, it could only ship it to Jiangsu, and now Jiangsu is willing to develop it itself, but cannot. There are many such situations in which resource development is restricted due to regional borders. This is the case with Hebei and Shanxi as well as with Sichuan and Guizhou. Thus, I think that in developing the coal industry, it is necessary to be primarily concerned about the industry, smash the restrictions of administrative divisions, and use rational development and utilization of coal resources as the guiding thinking and point of departure to establish plans for coal industry expansion which focus on the rational development and utilization of coal resources and advocate cooperative development and making the best of everything in line with the principle of mutual benefit.

2. Reforming Management Methods and Expanding Enterprise Autonomy

In the past, expansion of the coal industry was too overcentralized in plan management, product distribution, circulation system, finance, and pricing, which bound the enterprise hand and foot so that the coal industry lost the ability for self-reform and self-development. The Ministry of Coal Industry reformed management methods and beginning in 1985, during the Seventh Five-Year Plan period, according to the Ministry of Coal Industry, implemented in

national contracts, a contract system for enterprises which will include three aspects: 1) an output increase contract, increasing the price of overproduction; 2) a capital construction expense contract; and 3) responsibility for loss. Thus a contract which links these three aspects provides the enterprise with a certain degree of autonomy, mobilizes the initiative of the enterprise and its employees, expands production, and increases output and profits. However, for the coal industry to expand rapidly, I think that under the guidance of the state plan, i.e., directive type plans, enterprise autonomy should be further expanded to permit the free selection of capital construction projects, low-volume or post-plan overproduction foreign exchange trade, the participation in compensatory trade, and, with conditions permitting and accepting coal as primary, the development of joint ventures in coal-electricity, coal-gas, and other forms so that the coal enterprises will develop into comprehensive enterprises.

3. Adopting Effective Measures, Resolving Coal Shipping Problems

Since the distribution of China's coal resources is not consonant with the distribution of industry, for a long time "shipment of northern coal to the south" has been implemented and this trend will be difficult to change for a considerable time. Coal shipments now make up more than one-half of the volume of shipping on the nation's railways, and more than one-third of the volume of shipping by water. Even so, the primary coal producing areas still must "determine production on the basis of shipping."

Another major reason why there is an excessive volume of coal shipping, apart from the uneven distribution of coal resources and the failure to construct high energy consumption industries in the coal areas, is that coal is not processed. Currently, only about 15 percent of the coal produced is washed, and probably 3 to 4 million tons of rock are transported on the railways annually--a great waste of shipping capacity. Thus, resolving the urgent problem of coal shipping and improving coal washing capacity are very important aspects of improving coal quality.

However, resolving the key problem of coal shipping still rests on shipping method. A great many domestic specialists think that to resolve the problem of coal shipment, land and water shipment of coal from the north to the south should each be made coordinated parts of the overall plan as quickly as possible, adopting a variety of methods to make up for the inadequacy of railway shipping capacity. Piping of coal slurry is economically attractive and has passed technological tests. Comparing a 1,000-km transport distance with a railway, construction time for a pipeline is only one-third that for a railway, investment is one-half, and land used is one-seventh. I propose an appropriate pilot project.

4. Implement a Rational Pricing Policy To Promote Greater Expansion of the Coal Industry

Expansion of China's coal industry, in a certain sense, is limited by the low prices of China's coal. The current average market price for China's coal per ton is only 23 yuan, much less than the price of sand in some places and

this has an impact on the mining initiative of coal enterprises. In coal production there is a process of going from shallow to deep, and since coal costs increase as the mining depth increases, the price of coal should be constantly adjusted in accordance with changes in cost. Some reforms must be made in China's present coal pricing policy to make coal pricing more rational to promote expansion of the coal industry. While not carrying out any major adjustment of coal pricing, by applying economic leverage and in line with the demands of the laws of value and supply and demand, I propose that we implement a pricing policy in which unified pricing, increased pricing for overproduction, and free prices coexist.

Unifying Understanding, Increasing Investment, Designing and Developing Electric Power Development Plans With Large, Medium, and Small Hydropower Stations as Long-Range Guidelines

The primary manifestation of China's energy crisis is that coal production cannot catch up with electric power and electric power production cannot satisfy consumption. In 1984 power generated nationwide was 377 billion kWh (in 1985 it may reach 400 billion kWh), an average annual increase of 13.6 percent; generating capacity in 1984 was 8 million kW (in 1985 it may reach 8.5 million kW) an average annual increase of 11.4 percent. However, shortage of electricity becomes more serious year by year. According to relevant materials, in 1984 it was estimated that the national shortage of installed capacity was 1.2 million kW, a shortage of 50 billion kWh. The value of industrial production in the three provinces and one municipality of East China is one-quarter that of the nation, but its shortage of electricity is one-third; Guangzhou municipality's shortage of electricity is over 40 percent, and since 1980 it has purchased 1 million kWh of electricity daily from Hong Kong at a price more than five-fold that domestically; some overseas Chinese, compatriots in Hong Kong and Macau, and foreign businesses do not dare invest in China because of the shortage of electricity. The value of Liaoning's industrial production is about one-tenth that of the whole country, and the annual shortage of electricity is over 6 billion kWh, which has an impact on industrial and agricultural production. In terms of average annual per capita use of electricity, for China is about 380 kWh per capita, which is equivalent to 8 percent that of the Soviet Union, less than 4 percent that of the United States, and 2 percent that of Norway. Because of the severe shortage of electricity, 30 percent of the industrial production capacity nationwide cannot play its proper role. Many regions are constantly limiting electricity so that some factories and mines can only operate "3 days off, 4 days on" each week which creates serious economic loss. Even if we increase the volume of electricity of the generating equipment, forcing it to generate more, it still will not be able to ameliorate the supply-demand contradiction in electric power, but on the contrary, the contradiction will become increasingly serious. What should we do?

1. Establishing an Electric Power Development Plan Which for the Near-term Focuses Primarily on Thermoelectricity and Focuses on the Development of Large, Medium, and Small Hydropower Stations as Its Long-range Goal

On the basis of China's water and coal resources, the issue of electric power development in China should be for the short-term to focus primarily on the thermoelectricity and gradually shift the emphasis to hydroelectricity. This suits China's national circumstances. In view of the present situation, since the construction time for hydropower engineering is long, developing thermoelectricity is important for resolving this pressing need. However, as concerns the long-range situation, developing hydropower and simultaneously building on large, medium, and small scales is the direction for China's hydropower development. China has some 380 million kW of developable hydropower resources. Only 6 percent of the exploitable hydropower resources is currently being exploited. There are many untapped rivers and there is great potential for developing and building hydropower. Thus, accelerating the development of the electric power industry requires first of all that an electric power development plan which focuses on development of large, medium, and small hydropower stations as its long-range goal and we should gradually implement it beginning now.

2. Unifying Thinking and Striving To Put Electric Power in the Front Rank

In light of the experience of a variety of countries, "the electric power elasticity coefficient should be greater than 1," i.e., the rate of electric power development should be ahead of the development of the national economy. When postwar Japan was developing its economy, it also encountered the problem of a serious shortage of electric power. At a critical time, through analysis and research, Japan resolved to implement a principle of "excess of electric power" and implemented a "slanted policy" in the proportion of investment in electric power construction with investment in this construction for several years reaching more than 50 percent of gross construction investment, developing low construction cost, short construction time, and quick return projects thus accelerating the development of electric power construction and promptly and vigorously promoted the development of the national economy, achieving a flourishing development in the sixties and forcing itself into the ranks of the industrialized nations. China should learn from the experience of this success abroad, unify thinking, make a great resolution, adopt measures, really place electric power in first position and change China's electricity shortage as quickly as possible.

3. Restructuring the System, Opening New Sources, Raising Funds, and Promoting Numerous Plants To Produce Electricity

The electric power industry is one which is capital intensive, capital consumption is large and the turnaround time is long. In terms of just electric power engineering alone, if we are to satisfy the need for electric power for production at the end of this century, capital expenditure on electric power equipment and installation should be more than 1 trillion yuan. Yet China's investment in electric power over the past 35 years has only been 74.35 billion

yuan. In the United States, the investment in the electric power industry corresponding to 1 dollar of industrial output value in this industry is $4.50, for the machine building industry it is $0.50, and for the petroleum industry it is $0.80. According to statistics for the 20 years before the Fourth Five-Year Plan, the investment in the electric power industry corresponding to 1 yuan of industrial output value in this industry was 2.6 yuan, for the metallurgy industry it was 1.25 yuan, and for the petroleum industry it was 0.76 yuan. The investment needed by the electric power industry is several-fold greater than for other industry. But the gap in China's investment in the electric power industry is not only much greater than the United States, the disparity when compared to other industries is not large and this does not conform to objective laws. In China, the large amount of funds needed for the electric power industry, while in itself limiting national economic development, cannot be solved by depending on national accumulation and completely adhering to the current management system. So that there can be sufficient funds to satisfy the development of the electric power industry, it is necessary to reform the system, open new sources, and raise funds. In situations in which state investment must be relied upon for primary funds, methods of fundraising and bringing in funds, including issuing stock which can be purchased by individuals, should be adopted. We should cast off the traditional method of one firm engaging in producing electricity and fully mobilize the initiative of regions, departments, and units, combining nation, enterprise, collective, and individual, and large, medium, and small, open new channels, and have many firms engage in producing electricity. At the same time, a series of important reforms should be carried out in the electric power industry's management system and pricing and taxation policy to make it possible for electricity to nurture electricity so that enterprises can become self-remolding, have the ability for self-development, self-administering, and self-responsible socialist commodity producers and managers.

4. Reform Generators and Increase Rated Capacity

The amount of electricity generated is determined by the size of the rated capacity. In the past, overload generating to ameliorate the contradiction between supply and demand seriously affected the useful life of generators and equipment. To satsify the ever expanding demands of industrial and agricultural production and domestic use for electricity it is necessary to intensify scientific and technological research, use new technology to promote the development of the electric power industry, and through reforming generator equipment increase rated capacity and generating volume. For that generating equipment which is low in power, high in resource consumption, and wastes a great deal of energy, adopt advanced science and technology, reform and manufacture large-scale generators, and import as appropriate advanced technology of foreign large-scale generators.

Improving Chinese-Foreign Cooperation, Establishing Long-range Plans Focusing on Exploring for Oil and Natural Gas Reserves, and Intensifying Exploration of Off-shore Oil and Natural Gas

China is now the third strongest country in the world in terms of oil exploration. The petroleum system developed rapidly after the deep well rate

increased and the new "rolling" exploration and development procedures were put into effect through several years of readjustment, especially with the open-door policy in the petroleum industry, the expansion of enterprise autonomy, and the implementation of the 100 million-ton contract policy. In 1984 oil output reached 114 million tons, and in 1985 it is estimated it will increase 10 million tons. Judged from the proven reserves, last year's increase of 1.1 billion tons in proven oil reserves, increased by three- to four-fold over annual increases in the past and increases in proven resources of natural gas were more than 30 billion cubic meters exceeding the annual increases in past years by three-fold. The imbalance that appeared in the past between reserves and the volume of extraction is now gradually being ameliorated.

There is still a 20-year gap between China's oil industry and the level of the developed countries, primarily manifested in computerization of geophysical exploration technology: light well-drilling equipment such as that in the United States can drill wells over 6,000 meters deep. Although we have imported a great deal of Western advanced technology, our geophysical exploration technology may be still only a little better than that of the USSR, but in terms of the entire oil industry, basically we are only at the level the USSR was in the fifties. Thus, accelerating development of our oil industry is an urgent item in developing China's energy industry.

1. Establishing Long-range Plans Based Primarily on Exploring Reserves and Secondarily on Exploitation

In view of China's geological situation, to quadruple petroleum by the year 2000, reach an annual production of 200 million tons of oil and 100 billion cubic meters of natural gas is not a major problem. But in terms of the current exploration situation, there are certain problems in achieving this goal. If the Shengli oil field, for example, reaches an annual production of 50 million tons by 1990, it will become a second Daqing and to maintain this for 20 years, at least on the basis of existing reserves, we must find reserves of another 2 billion tons. In terms of natural gas, China's reserves are 340 billion cubic meters, according to the target demands, we will need 2.5 trillion cubic meters; the difference is very large and the task is very important. On the basis of this situation, the Seventh 5-Year Plan should focus on finding reserves, and manifest the thinking of reserves first, exploitation second. In terms of oil fields, we should intensify oil exploration in western regions, the south and off-shore, find reserves to replace eastern region oil development as reserve forces for expansion of the oil industry; in the process of exploration and development, the eastern region also should actively search for reserves to maintain the oil fields' stability of output. In terms of natural gas, we should intensify exploration in the northeast and Songliao regions, the Beijing-Tianjin-Tangshan-Liao He region, the region surrounding the oil fields in the Central Plain and in Sichuan, engage in off-shore natural gas exploration and development work and actively search for new gas fields.

2. Intensifying Cooperation With Foreign Countries

In view of China's current oil and natural gas exploration and development technology, it is critical that we intensify cooperation with foreign countries, especially in exploration in the western region and off-shore. While we have many difficulties in terms of technology, equipment, and quality of personnel, cooperation with foreign countries has a very big role to play. Last year the Ministry of Petroleum Industry implemented public bidding in off-shore oil and gas exploration with very good results. I think that we can also implement public bidding on some projects and in some areas on land, including permitting foreign and domestic enterprises to bid and public bidding may also be good for exploration of Sichuan's natural gas reserves. In the future we should intensify cooperation with foreign countries and it should constantly improve and expand in technology and number of projects.

3. Increasing Investment in Oil and Natural Gas Exploration

Oil extraction is like coal extraction: the volume of work invested and the costs of crude oil increase as the difficulty of extraction increases. In terms of current investment, there is a serious problem of insufficiency. Take Daqing, for example. For stable production, Daqing annually should drill over 1,000 regulatory wells and supplemental wells which requires a great deal of money and its own exploration and development funds are not enough, thus it is necessary to increase investment. In terms of natural gas exploration, during the period of the Seventh Five-Year Plan, there is no money in the oil exploration and development funds for finding natural gas reserves. According to comrades at the Ministry of Petroleum Industry, 500 million RMB have been reserved for natural gas as special exploration and development funds. However, this is too little, for if 6,000-meter wells are drilled this can at most cover the cost of drilling 20. Thus, I think that if we do not increase investment, even for gas-bearing basins and targets, there are no guarantees that we will realize annual natural gas production of 100 billion cubic meters by the end of this century.

At the same time, there is no way to prevent a variety of factors in the oil and natural gas exploration process from creating ever higher drilling costs. For example, during the great battle at Daqing, the cost of one well was 10,000 yuan, it has now increased to 40,000 yuan. Not only are the oil fields themselves unable to absorb this, it is not advantageous for the state either. The current importance of exploration, the shortage of investment, and the costliness of the expenses are not favorable for accelerating the pace of oil industry development. Thus, I propose that in the development of energy resources we formulate appropriate laws and regulations to be used for safeguarding the interests of investors.

4. Adopting New, Modernized Technology, Accelerating Exploration and Development

Although in the past few years we have imported some advanced technology and equipment, such as geophysical instruments, well measuring technology and steam generators, which have played a very big role in accelerating the

progress of exploration and development, in the area of technology and equipment we are still not all right: our level of well-drilling is still only one-third that of the United States. This is mainly demonstrated in the fact that equipment is outdated, technology is backward, efficiency is low, especially that well-depth, wedge-well and directional well technology is somewhat deficient, talent is in short supply, and the contradiction between complex technology and talent is very sharp. What are we to do? I think that the key issue is still "rights." I think we should further expand enterprise autonomy, constantly carry out technological reform and innovation, accelerate training, and through cooperation with foreign countries, gradually improve the level of modernized exploration and development, and use modernized technology to accelerate exploration and development.

Importing Foreign Advanced Technology, Formulating Short- and Long-range Plans for Nuclear Power Industry, Strengthening Research on Fast Neutron Reactors

In addition to vigorously developing the coal, electric power, and oil (including natural gas) industries, researching and developing the nuclear power industry is an indispensable aspect of resolving the energy shortage. According to foreign materials, at the present rate of consumption, world oil and natural gas reserves can only last 30-50 years. Other countries generally recognize that hydropower cannot increase greatly and that coal and nuclear energy are the most useable energy sources to replace oil in the near term. However, from the point of view of the restrictions of such conditions as the extractable reserves, extraction technology, transport capacity, and environmental protection of coal production and the rational utilization of coal, developing nuclear energy is the primary path and necessary trend for resolving the energy issue in the future.

Since nuclear power is an advanced energy source, it is the only commercial energy source which can currently replace conventional energy sources. Nuclear power generation has the characteristics of economy, safety, and hygiene and world nuclear power is developing very rapidly. By 1984, there was a total of 318 nuclear reactor generators worldwide with a nuclear generating capacity of 206.22 million KW and it is estimated that by 1991, the number of nuclear power plants in the world will increase by 169, and by the end of this century, the total number of nuclear power plants will increase to 528. France, Japan, the USSR, West Germany, and other countries will also move ahead rapidly and some medium and small countries, such as Belgium, Finland, Sweden, and some of the countries of Eastern Europe are actively developing nuclear generated electricity and nuclear-generated electricity in India and South Korea is also developing rapidly. To answer the needs for energy in areas of China where energy resources are in short supply, it is necessary to change the present energy resources structure and in southeast and northeast China and in regions where nuclear fuel is abundant, such as Hunan and Jiangxi to research and develop nuclear generated electricity so that nuclear generated electricity, coal generated electricity and hydropower together will become the three pillars of China's electric power suited to the development of the national economy.

1. Formulating Short-range and Long-range Plans for Nuclear Power Development and Making Them Part of the State Plan as Soon as Possible

To catch up with the other countries in the world we should have an overall goal, that is, we should have a plan for nuclear power development and it should be implemented under the direction of the state plan. Thus, the first task at present is to formulate short-range plans for nuclear power generating. Formulate long-range plans and comprehensive plans with full consideration of such factors as state finances, the industrial base, development conditions of nuclear power, the international market situation, and the importation and assimilation of technology. Through actively importing foreign advanced technology, in an organized and planned way absorb, digest, and accelerate the domestication of nuclear power generating. Fully utilize China's conditions which favor developing nuclear power to accelerate the pace of development.

2. Strengthening Scientific Research Work and Taking Training of Personnel Seriously

In the past we talked a great deal about the problem of conventional energy sources and overlooked the development abroad of new energy resources technology to the point that China's nuclear power began very late, creating passive situation of today where nuclear power must be developed by importing advanced technology and equipment. To ensure the healthy development of nuclear power, it is necessary to intensify research work on nuclear power. At the same time as we import advanced technology and equipment today, we must adopt independent specific measures with regard to the domestication to research, development and use of fast neutron breeder reactor technology and fully utilize natural uranium. At the same time, we should continue to stress research work on nuclear fusion to create conditions for truly resolving the energy problem in the future. To make the nuclear power industry grow and flourish, training talent in this area is the key.

Intensifying Research Work on Developing Renewable Energy Sources, Suiting Measures to Local Conditions, and Drawing on Local Resources To Solve Problems

In terms of the developmwnt of future energy sources, it is absolutely necessary to take utilization of renewable energy sources into account, especially with regard to its large role in resolving the rural demand for energy sources. For example, fast growing fuel forests, solar furnaces, wind-generated electricity, geothermal electricity, and the use of methane gas have played a very big role in resolving the current shortage of rural energy sources.

In China's northwest and in the east, the daylight period is long and there are conditions for developing solar energy; in the funnel formed by the long and narrow end of the Altai Mountains, the Kunlun range, and the Tianshan range and in the coastal area there are annually over 200 windy days with a high wind velocity, and these are good places for using the wind to generate electricity; in Tibet, the coastal regions and in some places in the interior, geothermal energy resources are abundant and geothermal energy can

be developed; China has 18,000 kilometers of coastline with conditions for tidal and wave-generated electricity. China also has much wasteland in the mountains and hills which can be planted in fuel forests.

To utilize renewable energy resources fully, it is necessary to proceed from the concrete situation, conscientiously carry out research work on developing renewable energy resources, implement the principles of "suit measures to local conditions, let many kinds of energy supplement each other, comprehensive utilization, strive for real effectiveness," conscientiously expand the utilization technology of methane gas pools, energy-efficient stoves, solar stoves, of wind power, water power, and geothermal energy, plant grasses and trees and develop fuel forests to create the conditions for rapidly developing the rural economy.

On the basis of China's national circumstances, we should still continue to conscientiously carry out energy-saving work, adopt effective measures, improve use of energy resources, and ensure that the gross value of industrial and agricultural output will quadruple.

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MODIFIED GAS TURBINES USED IN DAQING OIL FIELD

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 2, Feb 86 pp 4-5

[Article by Wang Zuhu [3769 4371 3338]]

[Text] According to a XINHUA report on 9 December from Daqing, China's first industrial gas turbine thermoelectric generator unit which uses an aero engine as a power plant and natural gas as fuel has been successfully tested at the Daqing oil field. The use of gas turbines provides a new way for oil fields to generate electricity using natural gas, and also provides a new industrial application of gas turbines. Since operation began in October 1984, the generator unit has accumulated over 6,900 hours of service at the oil field, generated more than 26.9 million kWh of electricity and produced more than 70,000 tons of steam.

From 27 to 29 November 1985, the Ministry of Aviation Industry and the Ministry of Petroleum Industry jointly sponsored a "Conference on the Evaluation of the WP-6G Gas Turbine Thermoelectric Generator Unit" at the Daqing oil field. Participants at the Conference included more than 80 specialists and professors from oil fields, petroleum plants, gas turbine manufacturers, research institutions, Qinghua University, and the Shanghai Mechanical Institute. The results from test operation during the past year show that performance of the generator unit was satisfactory and stable, and all technical indices have met the design requirements and confirmed the economic benefits of the unit. Thus, the birth of the first Chinese-made gas-turbine thermoelectric generator unit was announced.

Results of Cooperative Efforts Between Research, Production and User Organizations

After the 11th Party Congress, the central government established a new policy to encourage military-civilian cooperation and to focus military industrial technologies on civilian applications. The Ministry of Petroleum Industry and the Ministry of Aviation Industry had jointly established a policy of applying advanced gas turbine technology to enhance production in the petroleum industry and to achieve energy conservation. In March 1983, the Daqing Petroleum Administration Office and the Shenyang Liming Co. signed an agreement to jointly develop a thermoelectric generator unit by contributing

their technical expertise to the project. With the cooperation and assistance of the Nanjing Gas Turbine and Electric Motor Factory, Qinghua University, the Shanghai Gas Turbine Factory, the Shenyang Low-Pressure Boiler Factory, and the Jinan Senjian Electric Motor Factory, the Liming Co. and the Daqing oil field completed the design and construction of the factory buildings, the installation of natural gas, steam and water pipes and electric cables, and the design of the generator unit. The entire unit was shipped to Daqing in April 1984, and installation, tuning, and testing began in May; the first successful test took place on 9 July, and the unit began operation in October. The entire process of design, manufacturing, installation, testing, and operation only took 18 months. During the 12-month period ending on 30 October 1985, the unit had accumulated 6,988 hours of service, generated 26.98 million kWh of electricity, and produced more than 70,000 tons of steam. Operating at a 92 percent service rate, the unit has made significant contributions in power generation and energy conservation for the oil field, and it also marked China's first entry into the new era of thermoelectric power generation using gas turbines.

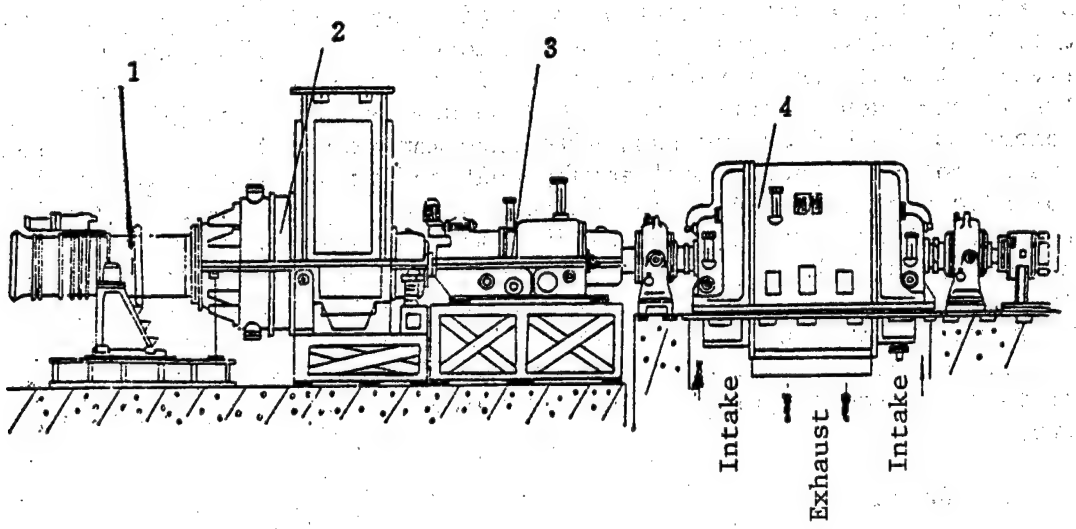
Benefits Derived From Advanced Technology

The gas turbine is an advanced power plant. Because the initial gas temperature (temperature prior to turbine entrance) can reach more than 1000°C, the temperature of the exhaust gas from the turbine may still be over 400°C. This gas can be piped into a residual-heat boiler to produce steam and hot water. The steam can be used in a steam turbine to generate electricity, in an industrial process, or for heating. This process of cascaded use of heat energy greatly enhances the utilization efficiency. The thermal efficiency of today's advanced aero-gas turbine is around 37 percent; the overall utilization efficiency of a thermoelectric system can reach 87 percent, of which the efficiency of high-level energy source--power generation--can be as high as 45 percent, which is unmatchable by other mechanical power systems. This is the basic reason why gas turbine has enjoyed rapid growth during the past 20 years. The earliest and most extensive use of gas turbine was in aviation. As a result of the rapid development of gas turbine technology and the high performance of today's gas turbines, they are now being widely used on military and civilian aircraft. Gas turbine technology in aviation is approaching maturity, and the large amount of development costs has been mostly recovered from aviation products. Therefore, many aircraft engine companies around the world are establishing shipbuilding and industrial divisions where aero-gas turbines are converted into power plants for ship and industrial use. Such power plants have the advantages of being cost-effective, requiring little investment, and being highly energy-efficient; they have become today's primary focus of technology development of the power industry.

The WP-6G generator unit is converted from the WP-6 aircraft engine; its structure and main components are shown in the accompanying figure.

As shown in the figure, the gas generator is a key component of the power plant. The newly designed gas turbine drives the generator (4500 kW) through a speed reduction box. The exhaust gas section is connected to the

residual-heat boiler, which can produce 13 tons of saturated steam at a pressure of 8 kg/cm^2; the overall thermal efficiency is 62 percent. Since the WP-6 is a mass-produced, Chinese-made generator unit, its relatively low efficiency is compensated to some degree by its low cost.



A Schematic Diagram of the WP-6 Generator Unit

1. The gas generator, which includes the compressor, the combustion chamber, and turbine, is the key component of the power plant. 2. Power turbine. 3. Speed reduction box. 4. Generator.

This generator unit is located at the natural gas pressurization station north of the Daqing oil field called the Beiya power plant. Steam is used in the processing of natural gas. The existing boiler of the oil field was shut down; instead, the natural gas is supplied to the gas turbine for power generation, and the residual heat is used for processing natural gas and for heating. Because of the highly stable pressure and temperature conditions of the generated steam, the amount of recovered light hydrocarbon is greatly increased; this resulted in higher economic benefits and improved living conditions for the personnel. Based on the results of operation after 1 year, the total cost of the generator unit is approximately 4 million yuan, whereas the payoff for the manufacturer and the user exceeds 5 million yuan per year. Thus, the total investment can be recovered in 1 year; this clearly demonstrates the social benefits that can be derived from advanced technology.

A Unique Mode of Operation

Because of the late start in developing industrial gas turbines in this country, a period of evolution in manufacturing techniques and a period of familiarization in operational procedures are required. In order to expedite the use of the generator unit, the Daqing oil field and the Liming Co. initiated an unprecedented cooperation effort: the Liming Co. operates the

power plant and pays for the cost of natural gas; the oil field on the other hand pays the cost of electricity and steam to the Liming Co.; in this manner, profits are shared equally and equitably by both. The Liming Co. is responsible for the operation of the generator unit; the oil field need not be concerned about its reliability. Experience during the past year shows that this is a very effective mode of operation. Without the foresight of the leaders of the two organizations and the full support of the oil field, it would not have been possible to achieve such outstanding results within such a short time. It also demonstrated that while advanced technology is the key to success, effective management plays an important role in promoting technological advancement and in developing the full potential of advanced technology. As pointed out repeatedly by the central government, in order to achieve the four modernizations, we must rely first on technology, second on policy. In other words, the road to the four modernizations is through reform. In parallel with developing advanced technologies, we should continually explore different modes of management best suited for advanced technologies and investigate reforms of the economic system so the potential of advanced technologies can be rapidly and fully realized.

A Growing Undertaking

An official of the Daqing oil field stated: "The increasing use of gas turbines in oil fields has yet to reach its full potential." With increasing depth of drilling in the oil field, the demand on electric power is greatly increased. The use of gas turbine in oil fields has a unique advantage not only in terms of high efficiency but also in terms of availability of fuel. Since installation was completed at the Beiya power plant, the Daqing oil field has installed two additional WP-6G gas turbines for driving the water pumps used for water-injection oil extraction; they will be ready for service at the end of 1985. In addition, there are plans to build several similar power plants. The Zhongyuan oil field and the Liaohe oil field are also investigating the possible use of gas turbines. Because of its outstanding energy-saving benefits, gas turbine has potential applications not only in oil fields but also in oil refineries, and in chemical, coal and transportation industries.

The WP-6G is China's first thermoelectric generator unit which still has room for improvement in many areas. Based on suggestions given by experts during the evaluation conference, the Liming Co. is taking measures to improve the reliability, integration, and efficiency of the generator unit. It is expected that the gas turbine will undergo major development in the future, and will make significant contributions in two of the key areas of the four modernizations--energy resources and transportation.

3012/6091
CSO: 4008/45

POWER NETWORK

BILLION-DOLLAR BOOST FOR POWER INDUSTRY REPORTED

OW251427 Beijing XINHUA in English 1221 GMT 25 Mar 86

[Excerpts] Beijing, 25 Mar (XINHUA)--Almost 1 billion U.S. dollars worth of equipment will be imported over the next 5 years to improve the East China power grid, it was announced here today.

The equipment will include generating, transmission, and transforming facilities for the Shidongkou No 2 power plant, the Beilunjiang and Tianshenggang power plants and a Xuzhou-to-Shanghai transmission line.

This was announced by Zhao Xiaoyuan, director of the Shanghai Power Supply Bureau, at a seminar here held in advance of an international electricity supply technology exhibition.

Power generating units with a total capacity of 10 million kW will be installed in the area between 1986 and 1990. This will be triple the generating capacity installed during the Sixth Five-Year Plan (1981-1985).

The East China power grid, one of the country's largest, provides electricity for Jiangsu, Zhejiang, and Anhui provinces and Shanghai--a well-developed part of China.

The area had an industrial and agricultural output value of about 300 billion yuan last year. Of this, the industrial output value of 235 billion yuan accounted for 27 percent of China's total.

Zhao said that to improve and expand the electricity generating industry, China was importing high-quality equipment from abroad while stepping up scientific research and strengthening the country's own manufacturing capacity.

The East China power grid imported more than 300 million dollars worth of equipment from Japan, Switzerland and other countries during the Sixth Five-Year Plan (1981-1985).

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CSO: 4010/42

POWER NETWORK

WORK ON 100-COUNTY PILOT PROJECT 'WELL UNDER WAY'

OW101154 Beijing XINHUA in English 1142 GMT 10 Mar 86

[Text] Beijing, March 10 (XINHUA)--A scheme to provide comprehensive electricity service for 100 rural counties by 1990 is well under way, a senior government power official said here today.

So far, five counties have been fully electrified, and another 10 are expected to be by the end of this year, said Vice-Minister of Water Resources and Electric Power Zhang Fengxiang.

By the end of the decade, at least 90 percent of the homes of the 33 million peasants living in the 100 counties, which are spread across China, will have electricity. It will also be widely used in industry and agriculture.

The government is spending an average of 100 million yuan a year on its plan to create model electrified counties.

But this is only 17 percent of the total investment. Most of the money to build hydropower stations and other facilities is raised locally.

Zhang said that under the plan, a total electricity generating capacity of 3 million kilowatts would be installed, and 11 billion kilowatt-hours of electricity would be generated in the model areas annually by 1990.

At present, a capacity of 2.33 million kilowatts has been completed or is being built.

Progress has also been made in constructing power networks. More than 230,000 kilometers of transmission lines has been erected--about 68 percent of the total required.

The vice-minister said the electrification program has greatly boosted agricultural production. Of the 100 counties, 66 were using electricity for agricultural and rural sideline production.

The program has also helped promote local industry and develop township enterprises, and in many places electricity has replaced wood as the main fuel for cooking.

He said the creation of these model counties was promoting the development of rural hydropower. According to ministry figures, more than 1,800 small hydropower stations were built throughout the country last year, with a combined generating capacity of 550,000 kilowatts.

This brings the total capacity of small rural hydropower stations to 9.52 million kilowatts, and the figure is expected to exceed 10 million by the end of the year.

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CSO: 4010/43

POWER NETWORK

FUJIAN FOCUSING ON LARGE-SCALE PROJECTS

OW030740 Beijing XINHUA in English 0728 GMT 3 Mar 86

[Summary] Fuzhou, March 3 (XINHUA)--Fujian Province is building 17 power facilities with a total capacity of 2.63 million kilowatts this year, a provincial official of the power industry said here today. Thirteen are hydropower projects with a combined capacity of 1.73 million kilowatts, and the other four are thermal power projects.

The purpose of building of these big projects, which represents a change from the past when efforts were concentrated on small hydropower stations, is to relieve power shortages resulting from local economic growth.

The state will invest 500 million yuan in these projects this year, up from 272 million yuan last year.

Construction of a 200 MW thermal power plant in Zhangping County in southern Fujian, began in January last year and is now ready for installation of the generating units. Infrastructure work for the 700 MW Fuzhou thermal power plant will be completed by the end of June.

A dam is being erected for construction of a hydropower station on the Shaxi He in the central part of the province, and preparation for construction of the 1400 MW Shuikou hydropower station is under way.

When most of these generating units go into operation in 1989, the official said, Fujian will be able to supply sufficient power to its industrial departments.

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CSO: 4010/43

INNER MONGOLIAN CONSTRUCTION IN SIXTH 5-YEAR PLAN

Hohhot NEIMENGGU RIBAO in Chinese 2 Dec 85 p 1

[Article by Li Shuxiu [2621 3219 4423] and Wang Zeou [3769 3419 2528]: "Power Industry Construction in Nei Mongol Progressing Well"]

[Text] During the Sixth 5-Year Plan, power industry construction in Nei Mongol made rapid progress and provided more and more energy for industrial and agricultural production and civilian consumption.

To date, 82 power plants of 500 kW or greater have been built, with a total capacity of 2.232 million kilowatts. By the end of 1985, the installed generator capacity in Nei Mongol is expected to exceed 2.432 million kilowatts. During the Sixth 5-Year Plan, the power production capacity increased at an average rate of 15.5 percent per annum.

From 1981 to mid-November 1985, the following power plants in Nei Mongol were put into operation: Baotou Thermal Power Plant No 1 (one 100,000 kW), Wuda power plant (two 25,000 kW), Jalainur power plant (two 25,000 kW), Tongliao power plant (one 200,000 kW) and Yuanbaoshan Power Plant (600,000 kW). A second 200,000 kW generator at Tongliao Power Plant will also come online at the end of 1985. By then the total power generating capacity of Nei Mongol will reach 7.8 billion kWh, an increase of 2.9 billion kWh over the 1980 level. In the last 5 years, nearly 2,000 kilometers of transmission lines 35 kV or higher have been installed, and 35,000 kV transformer stations with an installed capacity of 550,000 kVA were added, representing respectively a 21 percent and 27.5 percent increase over the 1980 level.

Since 1981, the pace of power industry construction in the agricultural and grazing areas of Nei Mongol has quickened. Today 82 of the 89 banners and counties have electricity. By the end of 1985 the power consumption in the farming and grazing areas will reach 1.36 billion kWh, or 55.6 percent more than the 1980 consumption level. A 168-kilometer 110 kV transmission line has been installed from Jalainur power plant across the Hulun Buir grassland to Hailar, and three new 110 kV transmission lines with a total length of 300 kilometers have been built for the East Xinba banner and West Xinba banner of the Hulun Buir league and the Siziwang banner in Ulanqab league. Wind energy has also progressed from research to application in recent years, and has entered a new era for large-scale utilization. By the end of October

1985, more than 10,000 wind powered generators had been installed. Sixty percent of the livestock raisers at Ulansumo in the Urad Zhong banner, Bayannur league have installed wind-powered generators and become China's highest wind power utilization region.

After extensive technological improvements, the Nei Mongol power grid has continually improved its equipment, increased its safety and gradually lowered its rate of accidents. In the Sixth 5-Year Plan, the power installation has conserved 149,000 tons of coal and 140 million kWh of electric power. Since 1981 the tax and profit contract payments of Nei Mongol Electric Power Administration have steadily gone up and exceeded 100 million yuan in two consecutive years.

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CSO: 4013/60

BRIEFS

GUANGDONG 7TH FYP EXPANSION--During the Seventh 5-Year Plan period, each year beginning this year, large and medium-sized generating units of 500,000 kilowatts will be put into operation to generate electricity in Guangdong Province. By 1990, the installed capacity of all power plants throughout the province will increase to 8.6 million kilowatts from 4.1 million kilowatts last year, and electricity output will increase to 29 billion kilowatt-hours from 17 billion kilowatt-hours last year. The situation in the shortage of electric power in the whole province will be mitigated. [Summary] [Guangzhou Guangdong Provincial Service in Mandarin 1000 GMT 13 Mar 86 HK] /12913

CSO: 4013/101

LI PENG ON THREE GORGES PROJECT, CREATION OF 'SANXIA PROVINCE'

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 4 Apr 86 p 1

[Text] At a reception for Chinese and foreign reporters held in the morning of 3 April, Vice-premier Li Peng stated that the Chinese government had taken a "positive but cautious" approach to the Sanxia [Three Gorges] project.

He said that the project, which incompasses flood control and navigation as well as the generation of electric power, concerns not only China's Four Modernizations but its future generations also. For these reasons, the government has not reached a decision on whether to build the project.

Li Peng added that although 30 years of preparatory work have gone into the project, problems still remain--the problems of silting and navigation, for example--that require further discussion and testimony.

He revealed that the State Council was preparing to establish a special committee on the Three Gorges project and will invite experts from all quarters to participate. The government would also be open to ideas and suggestions from experienced foreign experts concerning the building of the hydroelectric station.

He further stated that as of now, there is no plan to create a "Sanxia Province." There does exist a Sanxia Province Preparation Group, but it is only a working organ under the State Council and has no administrative authority. Its task is merely to handle investigations and relocation pilot projects.

CSO: 4013/106

BENEFITS OF PROPOSED THREE GORGES PROJECT STRESSED

Hong Kong JING BAO [THE MIRROR] in Chinese No 1, 10 Jan 86 pp 66-69

[Article by Zhang Rong [1728 2837]: "Exploring the Secrets of the Three Gorges Hydropower Station"]

[Excerpts] Not long ago, PRC Vice Premier Li Peng [2621 7720], who was accompanying Li Xiannian on a visit to North America, reasserted in Toronto that the Three Gorges hydropower project would have enormous comprehensive economic benefits and that the Chinese government certainly would work to build it.

According to the report, the design scale of the Three Gorges hydropower project is 13 million kW, which will exceed the "world champion" Itaipu hydropower station (with an installed generator capacity of 12.6 million kW) now being built jointly by Brazil and Paraguay. According to the hydropower development plans of various countries, the Three Gorges hydropower project, Zaire's huge Inga hydropower station and the Soviet Union's (Lutuhansike) hydropower station will become the "three heroes of hydropower" in the future.

Zhou Enlai Made a Personal Visit, Sandouping Was Chosen as the Dam Site

In the early 1950's Premier Zhou Enlai personally took charge of establishing the Chang Jiang Water Conservancy and Shipping Development Commission and the "Chang Jiang Office" established in Wuhan was headed by the hydropower specialist and brother of Lin Biao, Lin Yishan [2651 0001 1472]. In the summer of 1954, an enormous flood inundated more than 47 million mu of land and killed over 33,000 people. The Beijing-Guangzhou railway was shut down for 100 days because of the flood. The flooding led CPC authorities to decide to speed up control of the Chang Jiang and they developed a formal development plan for the Three Gorges. Mao Zedong held up the map in front of him and gestured abruptly at the Three Gorges, calling for it to be "accomplished it in one fell swoop." In 1958, Zhou Enlai met with various committees in the State Council and with the heads of the relevant provinces and cities and went to make an on-site investigation. The "Opinion Concerning the Three Gorges Key Water Conservancy Project and Planning on the Chang Jiang" was passed at the Chengdu Conference of the CPC Central Committee in March 1958, and Zhou chaired a

meeting at Beidaihe at the end of August that confirmed that the best site for a hydropower station in terms of optimum geological and topographical conditions was at Sandouping. Later, because of China's economic difficulties and the worsening of Sino-Soviet relations, this magnificent plan was laid aside once again.

In 1984, the PRC State Council approved in principle the "Research Report on the Feasibility of the Chang Jiang Three Gorges Key Water Conservancy Project" and agreed to preliminary preparations for construction. A Three Gorges Construction Preparation Guidance Department was set up in the Gezhouba Project Bureau and a group of construction personnel set up camp at the mouth of Letian Creek near Sandouping to open the curtains on this magnificent project.

The Leaders Visit Zhongbao Island, and Island "Whose Value Has Increased a Hundred-Fold"

Sandouping is located about 37 kilometers upstream from Yichang City in narrow Miaonan Canyon in the middle section of Xiling Gorge. The terrain is open and there is a large head to the water flow. The riverbed is hard granite bedrock and it has been approved as the best site for building the dam and power station.

There is a small oval island to the right of center in the river that is covered with orange groves and enveloped in a wonderful fragrance. Although it covers only 0.2 square kilometers, it is the only shoal containing a settlement along the nearly 200-kilometer length of the Chang Jiang Three Gorges. During the dry season each winter, one can walk from the island to the right bank of the Chang Jiang, but the water rises during the summer and the island is surrounded on all sides, so it is called Zhongbao ["central fort"] Island.

A large number of Neolithic artifacts have been unearthed on Zhongbao Island, including more than 5,000 stone items, more than 10,000 shards and more than 100 pieces of jade, bone, and horn.

After Sandouping was selected as the dam site, Zhongbao Island's "value increased a hundred-fold." Both President Liu Shaoqi and Premier Zhou Enlai visited the island. On 1 March 1958, Zhou Enlai led Li Fuchun [2621 1381 2504], Li Xiannian, Wang Renchong [3769 0117 6850], Liu Lantao [0491 3482 3447], Fu Zuoyi [0265 0155 5030], Qian Zhengying [6929 2973 5391] and some other water conservancy specialists from China and foreign countries to Zhongbao Island and investigated the entire island according to the design. They also examined rock cores from exploratory drilling.

At the end of 1984, Vice-Premier Li Peng boarded the Chang Yu No 11 special for the Sandouping dam site to examine Zhongbao Island. He walked through the orange groves and took out a telescope when he reached a high point to look at the Tanzi Range rising to the north, the sharp rocks running from north to south and the 2,000-meter dam axis line running across Zhongbao Island. Afterwards, construction on the Three Gorges Hydropower Station got underway.

Since China built the Gezhouba Hydropower Station at Yichang City, there has been constant debate concerning the various advantages and disadvantages of blocking the 10,000 li long Chang Jiang. After Li Peng announced the plan for construction of the Three Gorges Hydropower Station as a representative of the Chinese government at the Great Hall of the People in Beijing, the debate became even more intense. Of course, the success or failure of this enormous project that will require the state to raise a large amount of capital, materials and manpower is tied to the fate of economic development in China. A lesson should be taken from the Baoshan Steel Mill in Shanghai, which is precisely the reason that the Chinese authorities are unable to make a final decision. The debate concerning construction of the Three Gorges project to date can be divided into the following areas:

Will the Natural Ecological Balance Be Damaged?

1. Ecological balance

Over thousands of years, people have become accustomed to the mighty Chang Jiang as it passes from west to east across China. Since the first instance of flow cutoff at Gezhouba, a theory that the "natural ecological balance will be destroyed" has appeared. When the large dam blocks their natural movements, the aquatic life in the river, especially the precious ancient "living fossil" the Chinese sturgeon, of course will be unable to swim upstream to lay their eggs. In addition, when the large dam causes the water level to rise, it not only will flood a great deal of land but also will lead to a serious rise in the salt content of a large area of land around it and affect agricultural production. However, Sun Henian [1327 7729 1628], the deputy director of the Gezhouba Project Bureau and director of the Three Gorges Project Preparation Guidance Department, feels that such debate is only superficial. He said that during the almost 2,000-year period from 185 B.C. to the end of the Qing Dynasty and beginning of the Ming Dynasty [as published], more than 200 major floods occurred an the Chang Jiang that inundated untold amounts of land and houses and killed countless people. One large flood occurred every 10 years on the average, threatening man's existence and environment. The large 1931 flood inundated more than 50 million mu of land and the 1935 flood more than 20 million mu, and both killed more than 140,000 people. Why not control this stubborn "wild horse" now and turn disadvantage into benefit so that it serves the construction of China? The fish in the river, including the valuable Chinese sturgeon, certainly must move upstream and downstream to propagate. There was a similar problem at the Volga-Don River cascade hydropower stations in the Soviet Union. It was solved through artificial breeding and releasing sturgeon into the river. The Gezhouba Project Bureau established an aquaculture research office in 1983 and achieved success. Construction of the Three Gorges Hydropower Station, however, will not affect the upstream and downstream movement and propagation of the Chinese sturgeon in the Chang Jiang. When the large dam is built across the river and the water level is raised, it will result in obvious improvements in farmland and water conservancy and irrigation, so it is not fair to say superficially that it will raise the level of alkalinity in the soil.

Will the Silt Accumulation Issue Become a Problem in the Long Term?

1. Silt accumulation

Because of the long-term problems of silt accumulation at the Aswan Dam in Egypt and the Sanmen Gorge Dam on the Huang He, some people are concerned that after the Three Gorges Dam is completed, similar after-effects will occur. Some feel that this large dam that will require an enormous amount of capital can be maintained for only a few decades before it will become useless because of silt accumulation. Others feel that the forests and vegetation in the upper reaches of the Chang Jiang are better than on the Huang He and that there would be nothing like the large amount of silt carried in the Huang He because of the runoff over the loess plains. According to long-term records at the Yichang Hydrology Station, the silt content of the Chang Jiang is only a little more than 1 kilogram per cubic meter. The long-term average silt content is only 3.2 percent that at the Shaanxian County Hydrology Station on the Huang He. Moreover, there is a great deal of water in the Chang Jaang that flows rapidly. The flow rate during the driest season at Yichang is 1,300 to 1,400 times that in the Huang He and is roughly equivalent to the Huang He during the rainy season, so there still is a large silt flushing capacity. Chen Fuhou [7115 1607 0624], deputy chief engineer in the Gezhouba Project Bureau stated that more than 500 million tons of suspended load silt is carried to Yichang by the Chang Jiang each year. Gezhouba has silt flushing locks with a maximum flow rate of 10,000 meters per second that basically are capable of flushing the silt away. Silt along the banks can be removed through mechanical dredging. More than 730,000 cubic meters have been dredged over the past 4 years. Tang Richang [0781 2480 7022], deputy chairman of the Chinese Water Conservancy Society Special Commission on Silt, said that the most dangerous area was silt accumulation caused by the backwater of the tailwater region in the Three Gorges Dam reservoir. The water level in current plans is 150 meters and the tail of the reservoir lies in Changshou County downstream from Chongqing. The fiercely flowing river water will slow suddenly upon arriving at this location and form a backwater. Some are afraid that long-term silt accumulation will turn Chongqing Harbor into a "dead harbor." Specialists in the Chang Jiang Shipping Bureau hope to build a higher dam at the Three Gorges to achieve a water storage level of 180 meters, which would increase substantially the power generation capacity and permit 10,000-ton vessels to pass directly to the Chaotianmen Docks at Chongqing. Nevertheless, the experts feel that no increase in dam height and the use of mechanical dredging to clear shipping channels would not be a lot of trouble.

Do the Local People Welcome Construction of the Station?

Do the people support or oppose it?

A Reuters reporter sent a dispatch from Chongqing on 22 July 1985 stating that the number of people in Sichuan Province who oppose construction of the Three Gorges Dam "continues to grow." However, Li Baining [2621 0130 1337], former vice minister of the PRC Ministry of Water Resources

and Electric Power, has said that the broad masses of people in Sichuan's Fuling and Wanxian Counties and in Yichang Prefecture in Hubei are hoping urgently that the Three Gorges project will be built as soon as possible. Chongqing City also is doing its utmost to encourage an expansion in the scale of this project to gain their own benefits. Fuling and Wanxian counties still are poor regions, with peasant incomes of only 200 yuan per year. They are looking forward expectantly to the completion of the Three Gorges Hydropower Station and the economic emancipation it will bring them. The Yichang and Jing Jiang regions have suffered from floods for years. The flood prevention role of the Three Gorges Dam alone would be a realization of the wishes of the millions of residents there.

It has been said that the amount of electricity generated each year at the Three Gorges Power Station would reach 65 billion kWh. This could replace 35 million tons of coal or 18 million tons of petroleum used for thermal power generation and moreover would be non-polluting and would not involve the burden of shipping and handling large amounts of raw materials, so it has become known as a vast repository of energy resources. This area is located in central China at the intersection of southern water and northern coal and eastward transmission of electric power from the west. It not only could promote the formation of a nationally unified power system and provide sufficient inexpensive power for large-scale development of production, but also could benefit shipping activities on the "golden channel" of the Chang Jiang, expand farmland water conservancy and irrigation and aquaculture, and it could double the power generation capacity of the Gezhouba Hydropower Station.

12539/9190
CSO: 4013/84

ENVIRONMENTAL IMPACT OF THREE GORGES PROJECT STUDIED

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 1, 12 Jan 86 pp 8-10

[Article by Zhang Ruwan [1728 0320 8001] of the Chang Jiang Gezhouba Project Bureau: "Using Analogies To Forecast the Environmental Impact of Construction of the Three Gorges Project"]

[Excerpts] The Chang Jiang Three Gorges [Sanxia] project is an enormous key project that will be built in the future. The dam region has a limited environmental carrying capacity, a serious pollution load and poor natural conditions, so environmental issues are quite important for the construction region (period). For this reason, I will use the environmental pollution values of the Chang Jiang Gezhouba project as analogies for comparative analysis based on the scale of the Three Gorges project and the amount of engineering required in conjunction with natural environmental factors to provide forecasts and evaluations for use as references by the relevant departments.

I. Project Outline and Natural Environment of the Dam Region

If we use 150 meters as the normal water storage level in the Three Gorges project, the amount of engineering required would be: excavating 65 million cubic meters of rock and soil, pouring more than 20 million cubic meters of concrete, moving more than 35 million cubic meters of earth and rock fill, installation of about 170,000 tons of metallic structures, and shipping in a total of more than 28 million tons in freight. The intensity of construction: the maximum amount of rock and soil excavated in one year would be more than 12 million cubic meters and the greatest amount of concrete poured during a year would exceed 4.2 million cubic meters. The construction period, including 3 years of preparation, is estimated at 17 years. Raising the normal water storage level to 180 meters would require an even greater amount of engineering and longer schedules.

The Three Gorges dam site is located in Xiling Gorge 40 kilometers upstream from Yichang in Hubei Province. It covers an area of about 10 square kilometers and is located in a high mountain gorge. The foundation is firm granite with a silicon dioxide content of 68.9 percent. The area has a subtropical climate and an average yearly temperature of 16.8 degrees C. Relative humidity is 65 to 85 percent and annual precipitation

averages 1,155 mm. The wind is mainly from the southeast and arrives as a light breeze at a wind speed of 1 m/sec. The temperature inversion layer is 200 to 300 meters thick, a negative factor for the dilution and dispersion of atmospheric pollutants. The long-term average amount of runoff at the Three Gorges project is 14,000 cubic meters per second and the water has a strong capacity for dilution and self-cleansing. Although it has passed through the Gezhouba reservoir, the water quality still is excellent and toxic indices conform to state standards.

II. Borrowing From the Lessons of Environmental Pollution at the Gezhouba Project Region (Period)

The Gezhouba project was located in the suburbs of Yichang near a rolling area. The terrain was broad and flat and convenient for the deployment of construction and residential areas. Because of the inadequate attention given to environmental protection at the time, however, environmental issues were not included in preliminary design and layout of the construction sites, nor was the construction of residential areas integrated with long-range urban planning. Added to the lack of strict management during the construction process, a series of problems appeared: 1) Construction sites and residential areas ran together and affected each other, causing environmental pollution. For example, a service road and railway up to the dam and a trunk line of the Wuhan-Yichang Highway came together in the center of the work site. The number of trucks passing through reached a maximum of 800 trips per hour and the average was 544 trips per hour. There were frequent traffic accidents and the number of deaths due to traffic accidents from 1974 to 1983 was 1.78 times greater than the death rate for construction workers over the same period. The motion of construction vehicles covered with debris raised dust clouds and caused the amount of precipitated dust to exceed standards greatly. A parking lot for the noisy trucks was placed next to a school and the train power station was near a hospital. The pier for the sand and stone material, the sifting tower and the 2.5 kilometer-long material conveyor were placed near a residential area. The noise was serious and damaged the rest and health of the residents. (2) Buildings in the residential area were laid out chaotically. They were squeezed together, which has negative effects on ventilation, lighting and planting trees. The smokestack of the printing plant's typefoundry workshop was only a few feet from the residents' balconies. Sanitary facilities were incomplete in some of the buildings, which created many sequelae of the household pollution. (3) Public health facilities were incomplete and waste discharge systems were disorganized. Public restrooms were crude and too few in number. No means were available to handle garbage and there were no unified plans for sewer lines. Each unit did as it pleased and interfered with the others. The sewer ditches would fill up as soon as they were dredged and then require dredging again. Some of the waste from septic tanks was discharged into open ditches and sometimes there were no ditches, so the waste flowed slowly into the street and polluted the environment again.

III. A Forecast of the Environmental Effects During the Three Gorges Project Construction Period

Whether we are looking at scale, difficulty, intensity, construction schedules, total machinery power, fuel consumption, freight shipments or other questions, the Three Gorges project is 2 to 3 times larger than the Gezhouba project. More construction workers will be necessary than at the Gezhouba project and the environmental load will be heavier, but the environmental carrying capacity is lower than the Gezhouba project. If attention is not given to environmental issues, the results will be even more serious than at Gezhouba. Some of the problems that may be encountered are:

1. Forecasted atmospheric pollution: (1) The Three Gorges project will depend mainly on rock and soil excavation and the pouring of concrete structures, so silicon dioxide dust will be the main component of atmospheric pollution. This is a danger that cannot be ignored. (2) Besides coal and kerosene, fuel consumption will be more than 3 times greater than at Gezhouba. The waste gas and soot they produce are the main factors in organic pollutants in the atmosphere. An estimate of the amount is shown in Table 1. (3) There are influences from the atmospheric environment. The terrain and weather of the Three Gorges are not conducive to the dilution, dispersion and self-purification of atmospheric pollutants. In combination with a maximum depth of excavation of 90 to 120 meters, the wind through the mountain valleys may form eddies and retain fog at the bottom. Because of their relationship with the temperatures inversion layer, soot from coal burning and the exhaust from vehicles and boats also accumulates easily in the gorges. Besides an increase in amounts of the carcinogen 3,4-benzpyrene, the other gases will be affected by solar radiation and form the condition for London smog and photochemical smog. These things should be prevented as soon as possible.

Table 1. Fuel Consumption and Pollutant Discharges at the Three Gorges and Gezhouba Projects

Annual coal and fuel oil consumption (1,000 tons)

	Coal	Gasoline	Diesel
Three Gorges	48	15	52.5
Gezhouba	48	5	17.5

Pollutants discharged by burning coal and motor-powered trucks and boats (tons/year)

Soot	Lead Compounds	Sulfur Dioxide	Carbon Monoxide	Nitrides	Hydro-carbons
528	150.48	1,841.12	7,433.38	3,735.38	1,012.07
528	50.16	1,683.78	2,870.86	1,366.89	351.70

Note: See Ministry of Environmental Protection Environmental Statistics Handbook for method used in calculating amount of pollutants discharged.

2. Forecasted water pollution: (1) The "three household wastes" (garbage, human waste and waste water) are the main cause of pollution along the banks of the dam region. (2) If drinking water sources came into conflict with the overall layout of construction and are placed in a polluted region along the banks, drinking water may become polluted. (3) Busy water traffic is a main source of pollution along the banks. The amount of freight to be shipped during the Three Gorges project construction period will exceed 26 million tons and will be 4.2 million tons during the peak year. This is not substantially different from the amount of freight now being shipped by river. Eleven docks are to be installed in a 6-kilometer-long area along the left and right banks of the dam region. These will have negative effects on the water quality in the dam region and Yichang.

3. Forecasted noise pollution: (1) There will be an increase in machine noise. The large scale of the Three Gorges project and the use of high-efficiency machinery will lead to a multifold increase in total machinery power used in construction, so machinery noise also will increase many times. (2) There will be high intensity noise at the excavation site. The Three Gorges project involves extraction of hard stone, and two-thirds of the concrete base material will be man-made and will exceed 30 million cubic meters. There will be a great deal of drilling and blasting on a large scale to break up the stone, which inevitably will result in a great increase in noise in the narrow gorge. (3) There is serious traffic noise. First, a large amount of freight will have to be hauled to the construction site and will reach 900,000 cubic meters during peak months. If we include empty trucks, the total traffic working day and night would be almost 10,000 trips. Second, a large amount of material will have to be brought to the site. Even if most comes by water, the amount of freight hauled by highway would exceed 150,000 tons during the peak year. The maximum amount of daily shipping would be about 850 tons, and if we calculate at 4 tons per truck, it would require more than 210 trips a day. Third, there are substantial changes in the elevation of roadways which run along steep slopes and winding paths. Trucks will have to gas up, change their speed and brake frequently, which would greatly increase noise and exhaust. Even if an optimum program for road layouts were adopted, the danger of noise would be no less than at Gezhouba.

IV. Countermeasures To Protect the Environment of the Three Gorges Construction Region (Period)

1. Principles. With an ideology of macro-level guidance, consideration should be given to the overall project, urban prospects and environmental construction to integrate them organically and achieve simultaneous planning, implementation and development. In the area of micro-level measures, we should strengthen scientific management and voluntarily utilize the laws of ecological equilibrium to use advantages and avoid weak points so that nature serves man to an even better degree. The principle that should be employed in dealing with the special geographic location, natural conditions, international effects, tourism needs and so on should be: (1) Build the Sanxia City of the future into a modern city

based on a key water conservancy project that is famous for tourism and convalescence and built it into a center of the Three Gorges scenic area. (2) Facilitate visits and vacations in the construction site (period) by Chinese and foreign guests. (3) Use the terrain that has developed in the valleys as a natural barrier to atmospheric and noise pollution. Keep construction sites and residential areas separate and build auxiliary factories, warehouses, and docks close to the construction site. In addition, "labor insurance" measures should be improved to control pollution over small areas. Employees and their families should be taught to be concerned with the sanitation of their food and drinking water.

2. Measures. (1) When selecting the best construction program, strive to reduce and avoid environmental pollution. (2) Adopt modern construction technologies and advanced management methods to make full use of the Gezhouba base area to restrict as much as possible the number of personnel and reduce the load on the environment through measures like rotating days off for employees returning to the base area, placing certain auxiliary construction factories, schools and central hospitals at Gezhouba and so on. (3) Socialization of living services like apartment house dormitories and restaurant dining halls not only can reduce manpower but also can permit central heating. (4) Adopt damp-type activities and hermeticization and build clean atmosphere operations offices in special locations and use remote or automated operations for sand and stone preparation yards. Do blasting during optimum weather periods. Reduce boilers, central heating and household coal gassification to reduce atmospheric pollution. (5) Protect water sources, strengthen supervision over sanitation of drinking water and docks, install water supply and drainage systems according to urban demands and improve comprehensive and re-utilization rates for water. Waste discharged from hospitals and toxic waste water from industries should be purified before it is discharged. (6) Standards for highway trunk lines linking with the outside should be a grade-2 or better, and they should be separated from residential areas. Fixed noise sources should be controlled through technology and noise transmission and reverberation should be controlled. Sifting towers should have nylon grates and sound-proof walls. Soundproof rooms should be built in certain special locations. In addition, we can use protection of vegetation, afforestation and other methods to control noise pollution. (7) Establish organs to handle the "three household wastes" in a unified manner. Special attention should be given to dealing with human waste. Because there is not much farmland in the vicinity of the dam site, human waste should be shipped downstream by special vessel or detoxified. We should set up restroom trailers at construction sites to facilitate their mobility, and garbage should be cleaned up each day and purified locally. (8) We should have sound management, monitoring and research organs for environmental protection and adopt new achievements in modern environmental protection measures to control pollution.

The above comparisons and analyses indicate that there will be serious environmental pollution in the Three Gorges project construction region (period). However, if we have a high degree of concern for environmental

issues, adopt effective measures and focus on the key aspect of planning design and construction layout, and if we adopt modern scientific achievements in environmental protection and strengthen scientific management during construction, the environmental problems of the Three Gorges project construction region (period) can be solved.

12539/13252
CSO: 4013/90

NOTED ECONOMIST WARNS RESEARCH ON SANXIA INADEQUATE

HK010640 Hong Kong SOUTH CHINA MORNING POST in English 1 Apr 86 p 12

[Report from Beijing by Terry Cheng]

[Text] A massive construction plan for Sanxia project on the Huang He continues to cause controversy in Beijing, with renewed warnings of the dangers of inadequate preliminary research.

A member of the national committee of the Chinese People's Political Consultative Conference (CPPCC), Professor Qian Jiaju, has spoken forcefully against the project, which involves huge investment and would have a tremendous effect on the geography and ecology of the area.

In a recent group discussion, Prof. Qian, a noted economist, called for a halt to all construction projects in the country which have not been backed by scientific studies.

"We should pay special attention to those projects which have not yet been verified by feasibility studies and involve huge investment," he said.

Although not naming the Sanxia plan, on the upper course of the Huang He, it was understood that Prof. Qian had it in mind. He charged that there had been a lot of publicity about it in some quarters and that an attempt was being made to "force" the Central Government to proceed with it.

The massive project contimplated by the government is to generate more electricity and improve navigation, flood control and irrigation. An estimate put the construction cost at US$10 billion (about HK$78 billion). The involvement of an American firm in the plan has further complicated the debate. China has already paid US$1 million (about HK$7.8 million) to the firm as consultancy fee.

There have been suspicions in China that the United States may be trying to extend its influence in China by helping build the dam. The project has caused concern in Hong Kong and elsewhere. A Hong Kong member of the CPPCC, Mr Chak Nuen-fan, referred to it in a group meeting on Hong Kong and Macao members. He urged that the findings of scientific studies be made public. The implications and side-effects of the project must be made clear before it

can proceed, he said. "If the project does not proceed properly, it will cause a political storm in China," he said.

Chinese communities in the U.S. have also debated the project, with most urging Beijing to proceed with caution.

Taming the Huang He has been a dream of the Chinese for many years. Dr Sun Yat-sen, the founder of modern China, included it in a grand construction plan for the country.

The debate on the project has intensified in the past two years. Prof Qian and some other members of the CPPCC made a proposal at last year's session that in-depth studies should be carried out.

Acting on the proposal, the State Planning Commission and State Science and Technological Commission set about the task of organising such studies.

The Ministry of Geology and Mineral Resources organised a meeting attended by various specialists. They considered topics such as the safety of reservoirs and dams to be built at the Sanxia, earth tremors associated with construction and mineral resources at the area after construction.

The State Council has agreed that scientific studies on the project will be conducted over the next five years. A special group of the CPPCC also made a site inspection of the area. The group concluded that the project should not proceed in the near future, at least not in the Seventh 5-Year Plan which starts this year.

The group reported that the project could not solve flooding problems in the middle and upper courses of Huang He. The group said it would take a long time before the project could generate electricity.

/12913
CSO: 4010/44

BIDS FOR 1.1 MILLION KW YANTAN PROJECT OPENED

OW051203 Beijing XINHUA in English 1108 GMT 5 Apr 86

[Text] Beijing, 5 Apr (XINHUA)--Bids for the supply of engineering machinery and rolled steel for the construction of the Yantan hydroelectric project in the Guangxi Zhuang Autonomous Region were opened in public here today.

A total of 25 bids were received. Representatives from manufacturing firms of Japan, the United States, Federal Germany, Britain, Italy, Sweden, China, and Hong Kong attended the opening ceremony, which was under the auspices of the international tendering company of the China National Technical Import Corporation.

The project, financed by a World Bank loan of US$67 million, is one of China's key construction projects during the Seventh Five-Year Plan (1986-90).

Evalution of the bids will start soon, and contracts are expected to be awarded in June, according to an official of the international tendering company.

The power station, built on the Hongshui He, the largest river in Guangxi, will have an installed capacity of 1.1 million kW upon its completion in 1990.

/8309
CSO: 4010/45

HYDROPOWER

WORK ON HUNAN 1,200 MW STATION TO BEGIN IN 1986

Changsha HUNAN PROVINCIAL SERVICE in Mandarin 1100 GMT 2 Apr 86

[Text] The Wuqianxi hydropower station project, long desired by the people of the province, has been formally included in the state's Seventh Five-Year Plan. The project will be started this year.

This decision was made at this year's national planning conference. According to the plan, the hydropower station will have five 240,000 kilowatt generators and its annual generated power will be 5.37 billion kWh. Investment required totals 2 billion yuan, of which 30 million yuan will be invested this year. The project is being designed by the Dongnan Prospecting and Design Institute. Its construction will be undertaken by the No. 8 Engineering Bureau of the Ministry of Water Resources and Electric Power. It is expected to go into operation in 1994.

The building of the hydropower station is significant in terms of speeding up construction of the province's power industry, strengthening the readjustment capability of the power network and invigorating the economy of Hunan.

CSO: 4013/101

BRIEFS

LONGYANGXIA UPDATE--It has been learned from informed sources that due to the significant progress being made on the construction of the Longyangxia hydropower station, it is possible that the gates could be lowered and water impounded by the fourth quarter of 1986. Installation of two generators scheduled to go on stream in 1987 will begin this year. Today, work on pouring the main dam is 70 percent completed and the crest of the dam has risen to 130 meters. The Longyangxia hydropower station is the first large station to be built on the upper reaches of the Huang He; its four generating units will have a total installed capacity of 1.28 million kilowatts. On average, the station will generate 6 billion kilowatt-hours of electricity a year. The entire project is slated for completion in 1989. [Text] [Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 11 Mar 86 p 1] /8309

CSO: 4013/103

STATE COUNCIL APPROVES POWER PLANT EXPANSION PROGRAM

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 8 Apr 86 p 3

[Text] The State Council has approved plans and proposals to build a number of power plants and to expand existing ones. Principal among these projects is the Liaoning power plant expansion project, in which two 200MW generating units will be added to the plant's original 650MW capacity. Following the expansion, the plant's capacity would be boosted to 1.05 million kilowatts. The third-stage expansion project for the Mudanjiang power plant calls for the addition of 400MW in capacity. Added to the original installed capacity of 400MW, the completed project will have a total installed capacity of 800MW. The Jiangyou power plant in Sichuan Province is to be enlarged by the addition of two 300MW generating units; the project will be constructed with foreign capital and make use of imported generating equipment. The first stage of the Dezhou power plant in Shandong Province calls for the installation of two 300MW generating units; all of the necessary generating equipment as well as the associated transmission and transformer equipment will be imported using foreign capital. The expansion project for the Tongling power plant in Anhui Province calls for the addition of two 125MW generating units for a total addition of 250MW.

/8309
CSO: 4013/103

THERMAL POWER

GUANGDONG BANK TO GUARANTEE FINANCING OF SHAJIAO PLANT

HK040459 Hong Kong SOUTH CHINA MORNING POST (BUSINESS NEWS supplement) in English 4 Mar 86 pp 1, 3

[Article by Cecilia Ko]

[Text] Guangdong International Trust and Investment Corp [GITIC], with the full support of the Guangdong provincial government, will guarantee the viability of the joint venture coal-fired power plant in Shenzhen.

This is one of the crucial clauses in the proposal for the long-awaited $1 billion financing package for the $3 billion project, banking sources said yesterday.

Investors in the 700-megawatt Shajiao power plant include Hopewell Power (China) Ltd, a joint venture between Hong Kong's Hopewell group (50 percent), the Chinese authorities (45 percent) and the Japanese trading house Kanematsu (5 percent).

After more than a year of negotiations, Citicorp International, Bank of China and the Hong Kong and Shanghai Banking Corp yesterday began inviting more than 12 banks to join as lead managers for the loan.

The project is expected to come on stream in 1988, and will earn about $2 million a day by supplying power.

The loan, the first to be structured on a project finance basis in China, is divided into three branches--one of $600 million, another of 11 billion Euroyen, and a guaranteed facility of 52 billion yen, according to an announcement by Citicorp International.

Banking sources said although the loan is not guaranteed by any Chinese entity because of its project finance nature, lending-bank risks will be protected by various clauses in the loan agreement.

The most significant of these is a guarantee provided by GITIC to ensure that the Shenzhen Special Economic Zone Power Development Co. (SPDC) will fulfill its obligations under off-take and coal supply agreements.

Sources said under the off-take agreement, SPDC will buy about 60 percent of the electricity generated by the power station and pay for half of the electricity in Hong Kong dollars and Japanese yen at predetermined exchange rates.

The coal supply agreement stipulates that SPDC will supply coal for the power station, also at a predetermined price.

Sources said if SPDC failed to fulfill these obligations, GITIC will be held responsible under the guarantee clause.

This means GITIC will give an indirect guarantee on the project, thus enhancing the confidence of banks participating in the $1 billion loan.

Banking sources said this kind of structure will set a precedent for other project financing deals in China.

It is understood that under the loan agreement the bank syndicate will have a fixed and floating charge over all the assets, revenues and undertakings of the borrower.

In other words, the lending banks can hold the power plant as security for the loan, although banking sources said the banks may face practical problems in exercising this right because assets located in China are owned by the state.

No precedent exists for banks to confiscate assets pledged to them under a loan agreement with China.

The sources added that it is not certain at this stage how these problems can be overcome, but bankers emphasised that as the loan agreement will be based on Hong Kong law instead of Chinese law, it is assumed the Chinese authorities have accepted the banks' rights under this clause.

Sources also said the Chinese Government has shown full support for the project at state and provincial levels, as reflected by the composition of the Chinese partner in the joint venture company.

The Chinese entity holding 45 percent of Hopewell Power (China) comprises operating units owned by the state, Guangdong Provincial Government and the Shenzhen authority, the sources said.

The sources also said the $600 million and 11 billion Euroyen branches will mature in 1994 and the 52 billion yen guarantee facility will mature in 1996.

According to the Citicorp announcement, interest rates will be based on the Hong Kong interbank offered rate and the London interbank offered rate for the Hong Kong dollar and Euroyen tranches, respectively.

Both tranches will be charged at margins of 1 3/8 percent per annum for the period before the completion of the plant and 1 1/8 percent after completion.

The third tranche is a buyer export credit financing facility, under which the lending banks will provide a guarantee for the contractor of the power plant to obtain fixed-rate funds from the Export-Import Bank of Japan.

The contractor is a Japanese consortium comprising Mitsui Co. Ltd, Toshiba Corp, Ishikawajima-Harima Heavy Industries and Slipform Engineering Co. Ltd, the announcement said.

/6091
CSO: 4010/43

THERMAL POWER

BIDS FOR ZHEJIANG POWER PROJECT EVALUATED

OW260036 Beijing XINHUA in English 1719 GMT 25 Mar 86

[Text] Beijing, 25 Mar (XINHUA)--Fifteen bids to supply generating equipment for the Beilungang thermal power plant in Zhejiang Province were opened here today.

The project is being financed by a World Bank loan of 250 million U.S. dollars, which will be used to purchase generating units and boilers.

An official from the Ministry of Water Resources and Electric Power called the thermal power station a "major project" of the Seventh Five-Year Plan (1986-90) for the East China power grid.

The plant will have four units, and the first, with a generating capacity of 600,000 kilowatts, will be put into operation before 1990.

The international tendering company of the China National Technical Import Corporation conducted the public bid opening.

The bids will be evaluated over the next few months, and contracts should be awarded in June, according to an official of the tendering company.

The power station is located 26 kilometers east of Ningbo, Zhejiang Province. Coal for the station will be shipped from Shanxi Province in northern China.

/8309
CSO: 4010/42

PILOT PROJECT PROVES VIABILITY OF HEAT-POWER COGENERATION

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese No 6, 25 Dec 85 pp 34-36

[Article by Han Shuguang [7281 2562 0342], et al., Zibo Bureau of Mines:
"Collective Heat Supply Using Power Plant Waste Heat"]

[Summary] The heat absorbed by steam turbine circulating cooling water is generally wasted. The temperature of this circulating water is ordinarily only about 35°C, but by reducing the amount of circulating water and thereby creating a low vacuum, the temperature of the water can be increased to 58.17°-70°C, high enough to be used for heating. The Hongshan power plant experimented with a system to use this heated circulating water to heat nearby buildings. The power plant has a Japanese-made single-casing, medium-pressure condensing steam turbine and a Japanese-made 36t/hr coal furnace with a capacity of 5,000 kw. The heating service area is 200,000 square meters of buildings to the northeast of the power plant distributed within a range of 1.8-1.5 kilometers with a heating requirement calculated at 13 million kcal/hr. Experiments conducted in November 1981 indicated that by increasing the exhaust pressure to 0.263-0.408 absolute atmospheres the exhaust temperature could be increased to 65.3-75.85°C, increasing the temperature of the circulating water to provide heat. The volume of heat supplied was 13.70-14.43 million kcal/hr, sufficient for heating 200,000 square meters. The heat is delivered by trunk pipeline mounted on poles. Heating systems in the buildings depend on specific conditions and needs. In the 2 years of operation, the generator operated normally. The changes in vibration, axial thrust, and bushing temperature were not great and steam casing expansion was only 0.015 millimeter. The condenser operated normally and heat supply was stable. The thermal efficiency of the steam turbine generators increased from 21 percent to over 90 percent. The savings in coal was 3,624 tons per year, lowering the power plant's coal consumption by 103.5 cal/deg, lowering total generating costs by 10 percent and increasing value of output by 55,000 yuan. The area thus heated has been increased from 120,000 square meters to 200,000 square meters. The substitution for wasteful boilers and furnaces has saved 10,750 tons of coal per year, saved 376,600 kwh of electricity, eliminated 119 jobs, and saved 306,640 yuan in provincial funds. Total investment was 1,364,800 yuan, with a recovery rate of 44,500 yuan per year and net investment per energy unit of 178 yuan/ton of standard coal. Both of these indicators are lower than the state standard of investment of less than 250 yuan/ton of standard coal and the 5-8 year limit on investment recovery.

8226/9365
CSO: 4013/61

PROSPECTS OF COAL SLURRY AS REPLACEMENT FOR OIL OUTLINED

Beijing KEXUE SHIYAN [SCIENTIFIC EXPERIMENT] in Chinese No 12, 10 Dec 85 pp 2-3

[Article by Shi Fan [4258 1581]: "Replacement of Oil by Coal: The Rise of Coal Slurry"]

[Text] For some years people have been looking forward to the day when plant smokestacks would emit wisps of white smoke that would disperse in the wind and when foul, choking black smoke would no longer pollute the air. Today the use of a new type of material, coal slurry, represents one way of achieving this ideal. But the emergence of coal slurry has not been just the result of environmental protection: it also has a more important and far-reaching significance.

Origin and Development

After the oil crisis of the 1970's, many countries realized that an energy policy entirely reliant on oil would someday be unsound, and they therefore began to seek for a fluid material to replace petroleum. Under the guidance of this idea, coal slurry, a new material, appeared in the early 1980's.

In simple terms, coal slurry is a liquid fuel made from 70 percent coal, 30 percent water and a suitable amount of additive (about 1 percent). Because in many circumstances it can replace petroleum, it is now attracting increasing attention from many countries.

Internationally, oil reserves are limited, but the reserves for coal slurry are much more abundant and cheaper as well. As a result, more than 20 countries have joined the ranks of those studying and developing coal slurry. The United States and Sweden started early, and Japan and Canada also hastened into the race. China has extremely rich coal resources, and replacing oil with coal is of great importance here; consequently, in 1981 scientific and technical personnel in China began research in this area. They have already achieved gratifying progress.

Worldwide, coal slurry development is now gradually entering the industrial production stage, and its range of applications is gradually expanding: there are enticing prospects for replacing oil not only as a boiler fuel, but in other areas as well. For example, applications research on the use of a slurry with superlow coal content as a replacement for fuel oil in low-speed diesel engines and gas turbines is under way in the United States.

Preparation and Uses

Coal slurry is prepared by grinding superior-quality low-ash coal with high volatile content and high caloric content to a particle size of less than 300 microns in a ball mill and adding suitable amounts of additives.

The key to making the slurry is controlling the particle-size grading and quality of the coal. To produce high-concentration (70 percent or more) slurry with good flow properties (viscosity less than 1000 centipoises), the coal particles must have a particular size distribution, which must be chosen with reference to such factors as the physical properties of the coal and the characteristics of the ball mill in order to select the optimum characteristics for industrial production.

In order to assure the quality of the slurry, there must be strict control of the materials and reagents, the size grading and the amount of water added in the process, as well as of the slurry concentration and its viscosity and stability. Consequently most slurry plants have advanced, high-speed testing instruments to allow stringent monitoring of the slurry's flow rate, concentration, viscosity and pH.

Various additives must be introduced during slurry preparation, such as surfactants to improve flow characteristics, stabilizers to prevent precipitation, and disinfectants to prevent multiplication of bacteria and degradation of other additives during prolonged storage. The total amount of additives generally is about 1 percent of the weight of coal. Of the three types of additives, the most important is the surfactants, which are the key to formation of the slurry.

These additives are adsorbed by the coal, making its surface hydrophilic; when water is then adsorbed onto the treated coal, forming a water film, its viscosity decreases and the flow characteristics of the slurry are improved.

The cost of the additives is the key factor determining the production cost of the slurry. Research on these additives is therefore intensifying in all countries and a vigorous effort is being made to obtain additives for which there are extensive sources of raw materials and which are low in cost and have a wide range of adaptability.

Because it contains moisture which will evaporate on heating, coal slurry is rather slow to ignite and burn. In addition, because it contains solid particles, a spray process must be used in its combustion. Improvement of

spray performance is an important factor in achieving efficient, stable combustion. Because of these combustion characteristics of coal slurries, effective burner facilities must be provided. The burner consists of a spray nozzle and a draft controller and is the key to success in coal slurry combustion. If a coal slurry is to be used in an oil-fired boiler, its oil nozzles must be modified and it must be provided with microcomputer control and automated switching so as to assure safety and reliability; in addition, cloth dust-filter bags, ultrasonic ash removers and transport pumps and the like must be used to further decrease environmental pollution.

Advantages and Prospects

There are many advantages to replacing oil with coal slurries, and, as stated above, the production process is simple. Coal slurry is easy to transport over long distances by pipeline, ship or tank truck. It is stable during prolonged tank storage. It can be burned directly, without removing the water. Combustion is complete and rather clean, with no flyash, which is beneficial for environmenal protection. Its caloric efficiency is high, and it is a safe fuel, not prone to spontaneous combustion or explosion. Research by Chinese coal scientists has shown that a coal slurry may cost as little as 50 percent as much as fuel oil of equal caloric content. It can be used not only as a substitute fuel in oil-burning equipment, but also as a gasification feedstock for the production of low- and medium-caloric-value coal gas. Depending on the application, washed low-ash low-sulfur coal or ordinary-quality coal can be used to make slurries. Even low-caloric-value tailing water, suitably concentrated, can be used as a starting material. Thus the emergence of coal slurries as a new type of fuel and gasification feedstock has opened a new avenue to the rational utilization of coal and upgrading of its utility value. The evaluation of coal slurry by a Japanese group that investigated it is that as an economical fluid fuel it opens up entirely new prospects for coal utilization, and that it constitutes an epoch-making technology which gives new viability to the utilization of coal.

Looking back over the scientific results obtained in various countries as a result of assiduous research on coal slurries and looking forward to future energy development, we can predict that by virtue of their unique characteristics and clear technical and economic benefits, coal slurries will move to the forefront of energy resources and will provide mankind with even more light and heat.

8480
CSO: 4013/70

NINETEEN MAJOR MINES COMPLETED DURING 6TH FYP

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 25 Dec 85 p 3

[Article by reporter Zhang Huchen [1728 5706 5256]]

[Text] During the Sixth Five-Year Plan (1981-1985), 19 coal mines were completed and put into production in China's 14 major coal mining construction areas. Their completion has added 29.64 million tons to China's annual coal production capacity.

Of the 19 completed coal mines, 6 are extra large, modern mines, each with an annual production capacity of 3 million tons of raw coal.

In the 14 mining areas, 31 other mines are still under construction and expected to be completed in the early 1990's. When completed, these coal mines will have a combined capacity of 74.10 million tons.

The major mining areas under construction include: Kailuan in Hebei; Datong, Yangquan, Gujiao and the opencut mines of Pingshuo and Antaibao in Shanxi; Huolinhe in Nei Monggol; Pingdingshan in Henan; Dadun in Jiangsu; Huainan andd Huaibei in Anhui; Yanzhou in Shandong; and Shuangyashan and Tiefa in northeast China.

Most of these major mining areas are located in northeast China, where lie most of the country's heavy industrial installations, and economically more developed north and east China regions. When completed, they will help ease the coal shortage in these regions and will become the mainstay of China's coal production.

In their construction, these major coal mines have generally adopted a project management system and a contract construction economic responsibility system. Thus, the units contracted for construction work can give full play to their own initiative and, on condition that the overall design principles are not changed, improve the designs and make full use of advanced technology and equipment to increase construction speed. In the past, it took 10 years to build a large coal mine. It takes about 6 years now.

The new coal mines will be fully mechanized, and more than 70 percent of them are to be multiple-producing operations. At the same time, safety and

environmental protection measures will also be greatly improved. Most of the mines will be equipped with automatic gas monitoring devices and computerized controls.

China's Ministry of Coal Industry is actively making use of foreign capital in the construction of the major mines. A total of U.S.$1.51 billion of foreign capital was used in the construction of 12 mines in the Sixth Five-Year Plan period.

12802/12948
CSO: 4013/80

ANHUI LOCAL MINES PASS 50-MILLION-TON MARK IN 1985

Hefei ANHUI RIBAO in Chinese 26 Dec 85 p 1

[Article by Wang Shishun [3769 0013 7311]

[Text] Local coal mines in Anhui have reached the 3.5-million-ton state production goal for 1985 4 months ahead of schedule and by the first part of December have exceeded the 50-million-ton annual production level, thereby putting Anhui over the "second tier" threshold in its coal development plan 5 years ahead of schedule.

Over the last several years the local coal mine system of Anhui has worked hard in implementing a series of coal production policies and directives of the Central Committee and devoted its efforts in the following two areas:

The Anhui coal mine system first made the strategic switch and then established a plan to concentrate on the coal bases in northern Anhui while not neglecting the small coal mines in southern Anhui. During the Sixth 5-Year Plan, the Anhui Coal Administration proposed to develop more and bigger coal mines in Huainan and Huaibei, especially Huaibei. After years of hard work, five pairs of coal mines in northern Anhui are now in production, and the production level will be increased by 2.4 million tons after the completion of the first phase of the engineering improvement project. Four pairs of mineshafts at Liuqiao-2 Renlou, Qinan, and Zhangji are under construction. These new coal mines will boost the production level by 8.5 million tons.

Second, a large effort was made to develop township and town coal mines. Following the Central Committee ppolicy of developing coal production with a combination of state, collective, and individual effort for quick return, the Anhui Provincial Coal Administration has made a good effort to develop township and town coal mines to take advantage of the low capital outlay, quick return and sensible layout of the small coal mines. To encourage the development of small coal mines, the provincial government has provided 8.57 million yuan for loans. The number of township and town coal mines in Anhui has increased ten-fold, from the original 100 small mines to more than 1,000, producing a total of 6.2 million tons of raw coal in 5 years, which accounts for 35 percent of Anhui's total coal production in the Sixth 5-Year Plan.

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CSO: 4013/60

HENAN COULD USE MORE COAL RESOURCES FOR POWER GENERATION

Zhengzhou HENAN RIBAO in Chinese 3 Mar 86 p 4

[Article by Liu Jizhi [0491 4949 2535]: "Focusing on Power Generation for Comprehensive Utilization of Coal Resources"]

[Text] Henan has abundant coal resources. The development of pit-mouth thermal power plants to convert coal into electricity locally can solve the long-term power shortage in industrial and agricultural production in Henan, and it also is more economical to transmit the electricity to other areas than it is to ship in coal. This could alleviate the shortage of rail shipping capacity and reduce coal overstocks. In addition, it could develop comprehensive utilization of coal and lead to the development of newly emerging industries. For this reason, comprehensive utilization of all of Henan's coal resources with a focus on power generation should become an important part of the guiding ideology in Henan's economic development strategy. We were unclear about this in the past, however, and "went begging with a golden bowl." For a long period, Henan has sold coal to buy electricity and instances of backward flows of coal and electricity, coal overstocks and waste have occurred. Henan had a power shortage of 2.4 billion kWh in 1984, for example, and the shortage was even greater in 1985. The switches were thrown and power restricted more than 240 times on the worst day, and it meant that 20 to 30 percent of Henan's industrial and agricultural production capacity could not be used. Losses were in the billions and household electricity use in urban areas also was affected. Comrade Hu Yaobang pointed out during a visit to Henan in April 1984 that "it is most economical to convert coal into electricity locally. The 67,000 kW yearly increase in power in Henan over the next decade and longer will be equivalent to one-tenth of the total increase in China." His statement has opened up our ideas. We should use major efforts to develop small-scale thermal power as a basis for comprehensive utilization of coal focused on power generation. By starting from actual conditions in Henan, I feel that during the Seventh Five-Year Plan or for an even longer period of several decades, we should concentrate our manpower, materials and financial resources in western Henan, northern Henan (in the Jiaozuo area) and in southern Henan (in the Pingdingshan area). The reason is that these three regions have coal and water as well as an existing thermal power base. They also have convenient transportation, can go into production quickly and will provide

results at an early date. Construction of pit-mouth power plants in western Henan for local conversion of coal and hydropower resources not only could reduce the pressure on railway transportation from out-shipments of coal from Shaanxi, Shanxi and Henan, but it also could meet the electricity needs of railway electrification within the region and improve railway shipping capacities. Moreover, it could reduce coal shipments and increase electricity transmission, so it could save Shaanxi and Shanxi from their coal overstocks and solve eastern China's "thirst" for electricity, which would result in further improvements in social results and comprehensive economic results. Within Henan, the achievement of comprehensive utilization focused on power generation in the short run could alleviate the contradiction between energy resource consumption supply and demand, especially in the long term situation of having to buy electricity, and it could make use of production capacity that has been unused because of the power shortage, which would recover nearly 10 billion yuan in losses each year. Moreover, it could reduce waste of coal resources and increase benefits (according to calculations, the profit per ton of coal is more than 3 yuan, while dressing and processing could increase profits by 8 yuan; if the value of coal directly is 1, coversion of coal into coke could increase the value 10-fold. Processing it into plastics could increase the value 90-fold, dyes would increase the value 370-fold and synthetic fibers increase it even more). Preliminary preparations for large-scale thermal power electricity resource points in western Henan are underway. The main body of construction at the large Yaomeng, Jiaozuo and Shouyang thermal power plants will be completed and the new Hebi power plant will be built in Henan during the Seventh Five-Year Plan. The preliminary idea is that a group of power stations will be build in these three large-scale thermal power base areas. In addition, Shaanxi coal and Huang He water could be used to build the Sanmen Gorge West power plant and Yima coal and Huang He water could be used to build the Yima power plant. Coal from Dengfeng and water from the Jiahekou reservoir could be used to build the Jiahekou power plant, a group of old power plants could be expanded and rebuilt, and a group of small thermal power plants also could be developed. By the end of this century, the estimated total installed generator capacity would be almost 15 million kW and the electricity generated in western Henan alone basically could meet the province's needs.

Henan's coal fields not only have large reserves, but they also have a full complement of product varieties and a large amount of rich mineral accumulations that were paragenetic with coal, so there are favorable conditions for comprehensive utilization of coal resources. Development and utilization of coal gangue could permit establishment of two production systems: gangue and the boiler slag from gangue used for power generation is a good raw material for bricks, cement, and pre-formed structural members, so it can be used to form a construction materials production system. Aluminum oxide, vanadium oxide and scattered elements like potassium and germanium can be extracted to form a metallurgical system. Development and utilization of anthracite, jet coal, lignite and

weathered coal can form a chemical industry production system for chemical fertilizer, synthetic fibers, rubber, plastics and other products. Development and utilization of anthracite, jet coal, lignite, weathered coal and mine gas could permit formation of a coal processing system for coal, coke forming, coal gas and so on. In addition, surplus heat from power plants can be developed and utilized for the formation of a heat energy utilization system for heat supply (steam and water). Practice in intensive coal processing and comprehensive utilization at the Pingdingshan coal base area has confirmed this point. After dressing the coal, the Pingdingshan City coking plant burned it to make coking coal and made more than 3.8 million yuan in actual profits in 1984. Moreover, the chemical components produced during the coking process were separated, purified and converted into 14 semi-finished chemical industry products like carbon black, toluene, and power benzene and they made more than 770,000 yuan in profits in 1984. In addition, they recovered the environmentally polluting coal gas to build Henan's first coal gas project. Powdered coal ash now is undergoing comprehensive utilization in seven scientific research, environmental protection and enterprise units in Pingdingshan City to produce 10 types of new products like hollow microspheres, which provide per-ton profits as high as 80 percent. It is obvious that there is great potential for development of comprehensive utilization of coal resources focused on power generation.

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CSO: 4013/95

MAJOR CHANGES IN SHANXI COAL PRODUCTION REPORTED

Taiyuan SHANXI RIBAO in Chinese 25 Feb 86 p 1

[Article: "Major Changes Have Occurred in Shanxi Coal Production--There Has Been a Change From Simple Coal Extraction to Multilayer Development and Utilization"]

[Text] Major changes have occurred in coal production in Shanxi Province, a key energy resource base area in China: simple production and out-shipment of raw coal now is history and a new situation of multilayer development and utilization of coal now is taking shape. Shanxi shipped out more than 130 million tons of raw coal in 1985, and it also converted more than 10 million tons of raw coal locally into more than 2 billion kWh of electric power and more than 3 million tons of products like calcium carbide, chemical fertilizers, and coking coal, pig iron and other things that are being shipped throughout China. This important transition is indicative of the fact that the Shanxi energy resource base area has begun to throw off its past single economic pattern of extracting and selling coal and that it now is shifting toward a focus on the coal industry and has made great progress toward comprehensive development of the electric power, metallurgical, chemical and construction materials industries.

Increases in coal output in Shanxi since 1980 have greatly exceeded improvements in out-shipment capacity and created large overstocks of coal. Economic results in many areas and in many townships and town coal mines have fallen year after year. Comrades Hu Yaobang and Zhao Ziyang pointed out clearly during their work investigation in 1985 that Shanxi should strengthen work related to local processing and conversion of raw coal, and it should make full use of its coal resource advantages to develop the ferrous and nonferrous metals industries, the chemical materials industry and the construction materials industry. In accordance with the spirit of this instruction, the Shanxi provincial government has adopted a series of measures in industrial management, technical and economic policies and other areas, and it has taken action to develop local processing and conversion of raw coal. Shanxi has used various channels to raise more than 300 million yuan in capital from within and outside the province and it has set up thousands of small iron mines, calcium carbide mines and construction materials mines in more than 70 coal-producing counties. The three levels of the province, prefectures and counties

also have examined and signed more than 260 technical cooperation projects with units outside of Shanxi, and they have brought in more than 200 million yuan in capital and made preparations to build a group of key enterprises. There were 225 small blast furnaces that went into operation in Shanxi in 1985, and 303 additional ones now are under construction. According to estimates from the relevant departments, after all these small blast furnaces go into operation with their total volume in excess of 6,400 cubic meters, they can "eat up" more than 4 million tons in raw coal, while annual pig iron output will surpass 200,000 tons. The development of small iron mills also will lead to construction of a group of related industries like mining, coking, machinery, construction materials, transportation and so on. Estimated profits could increase by 200 to 300 million yuan per year and jobs could be provided for almost 100,000 rural laborers.

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BRIEFS

SHANXI LOCAL MINE GROWTH--Output in Shanxi's local coal mines developed in a sustained and steady fashion during the Sixth 5-Year Plan. Output rose at an average annual rate of 15.37 million tons during the period of the plan. Production in 1985 was 136.49 million tons, accounting for some 63 percent of the province's total coal output and 31 percent of the output of local coal mines in the whole country. The newly formed provincial coal department held a gathering of labor models in the local coal industry on 7 April. [Summary] [Taiyuan Shanxi Provincial Service in Mandarin 2300 GMT 7 Apr 86 HK] /12913

CSO: 4013/101

PETROLEUM INDUSTRY SETS TARGETS FOR SEVENTH FYP

Hong Kong JINGJI DAOBAO in Chinese 27 Jan 86, pp 22-23

[Excerpt] The Seventh Five-Year Plan [7th FYP] is a crucial period for China's petroleum industry development. The goal is to achieve an annual crude oil output of 150 million tons by 1990 and to establish a sound foundation for greater developments in the following 10 years. By the end of this century, the development of China's petroleum industry must catch up with the nation's needs, the production of oil and gas must grow at the same rate as that of the national economy, and China must become one of the major oil producing countries in the world. The production of natural gas must be greatly increased to match the production of oil so that natural gas may become an important source of energy in the development of the economy. The incompatibility between the technological development of petroleum science and the management and production of petroleum must be addressed. Efforts must be made to elevate the level of survey, oil field construction, oil and gas transportation, and integrated utilization of the oil and gas resources to the world standard, and first rate petroleum experts and management personnel must be trained.

The principal policies of China's petroleum industry during the 7th FYP are: Let petroleum prospecting play a leading role and concentrate on prospecting in eastern China, continue to expand the scope of prospecting in the eastern region and increase the amount of new reserves. In the meantime make a major effort in petroleum prospecting in western China and offshore, seek new major oil and gas fields, and cooperate with foreign companies in the development of the ten provinces and regions in southern China. Maintain a steady growth in crude oil production, concentrate on the six large oil-producing zones at Daqing, Shengli, Liaohe, Zhongyuan, Huabei, and Dagang, raise the crude oil output of these six regions from the 89 percent level (out of the total national crude oil production) in 1985 to 92.5 percent in 1990. Put the development of natural gas on a equal footing with the development of oil. While expanding the natural gas development in Sichuan, actively search for new gas fields so that the output of natural gas can be increased by a substantial margin. Strengthen the integrated utilization of petroleum and natural gas, achieve oil and gas transportation in closed systems, separation in stages, and adequate recovery. Actively promote advances in science and technology, personnel training, and petroleum science research. Continue to develop trade and technological exchange and

import advanced technology and equipment that are currently beyond China's ability in producing. Quickly absorb and master the imported technology so that it becomes part of the production capability. The goal of the efforts during the seventh FYP is to achieve the early 1980's international standard in major petroleum prospecting and development technologies and to lead the world in certain areas. Continue to work on cooperation with foreign companies, perform according to the contracts, protect the interests of foreign investors, and attract foreign investments, technology and talents. Continue to work on reform, expand the autonomy of the enterprises, perfect the economic responsibility system in crude oil production, establish responsibility systems in prospecting and development, and carry out the contract and bidding practice in the development of the contract system of specialized engineering technical services. Centered on economic efficiency, gradually reform the leadership structure of the enterprises, reform the wage and bonus system, strengthen the basic work, promote modernized management so that more output can be obtained from less investment .

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CSO: 4013/91

OIL AND GAS

OFFSHORE EXPLORATION POLICIES EASED IN FACE OF PRICE SLUMP

HK010750 Beijing CHINA DAILY in English 1 Apr 86 p 1

[Article by staff reporter Xu Yuanchao]

[Text] The slump in world oil prices has made China adopt more flexible policies in offshore exploration to attract foreign oil firms.

The contracts usually call for foreign oil companies to take sole risk during the exploration period and requires them to finish exploration in their awarded blocks whether they find oil or not.

However, according to CNOOC [China National Offshore Oil Corporation], some firms that did not find oil asked to move to other blocks to avoid wasting time and money in hopeless areas. This has been granted by CNOOC after negotiations.

Occidental Eastern drilled several dry wells in the 28/23 contract block and asked to finish its incomplete exploration programme in the new contract block, where it struck oil.

The China National Offshore Oil Corporation (CNOOC) yesterday announced a new oil well has been drilled in the Pearl River Mouth Basin of the South China Sea. The first two oil layers tested in the well indicate it can produce 2,100 barrels a day. There was a no output estimate for the third layer because of technical problems in the test.

The well was struck by Occidental Eastern, Inc of the United States in partnership with six other oil companies called the Lufeng 15-1-1 well, it is about 370 kilometres southeast of Guangzhou in the 17/15 contract block, which CNOOC called "an appendant area" to the 28/23 contract block awarded to Occidental in China's first round of bidding, on oil exploration contracts.

"The slump in oil prices has not had a great impact on China's fledgling offshore oil industry," a CNOOC official said. The second round of bidding is going on. No oil firms have withdrawn from negotiations.

"The decline in oil prices did not dampen foreign firms' interest in China's offshore areas," he said. "On the contrary, some far-sighted companies think this is a good time for exploration."

According to CNOOC, China has so far signed 31 contracts with 40 oil companies from 12 countries for exploration rights in the Bohai Sea, South Yellow Sea, South China Sea, Beibu Gulf, and Yinggehai area. Foreign oil companies have put down a total of 120 wells, 46 of which have reported finding oil.

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PETROLEUM INDUSTRY GIRDS FOR IMPACT FROM TUMBLING PRICES

HK060756 Hong Kong AFP in English 0649 GMT 6 Apr 86

[Report by Lawrence MacDonald]

[Text] Beijing, 6 Apr (AFP)--Plunging international oil prices are pushing China's state oil sector to be more flexible in its dealings with foreign oil companies, industry analysts said here.

The new policies, some of which are still being formulated, are intended to cushion the impact of falling prices on two crucial areas of the Chinese economy which could otherwise be badly hurt--foreign exchange earnings and energy development, the analysts said.

Petroleum is China's largest single export sector, supplying 20 to 25 percent of its trade earnings, according to state figures, and analysts said that falling crude prices threaten to aggravate the country's trade deficit, which last year reached a record 14.9 billion dollars.

Foreign Trade Minister Zheng Tuobin told Hong Kong reporters last week that China would lose 200 million dollars per year for each reduction of 1 dollar per barrel in the price of crude, or 2 billion dollars for a sustained reduction of 10 dollars per barrel.

Prices on world spot markets dropped below 10 dollars per barrel last week from about 28 dollars per barrel at the beginning of the year.

Industry sources said China was temporarily buffered from the worst effects of the fall, since much of current-delivery crude fetched prices fixed in contracts negotiated last year, before problems developed in the Organization of Petroleum Exporting Countries (OPEC) and prices started tumbling.

That is likely to change, however, as China is forced to accept more flexible contracts to achieve the announced goal of maintaining exports at 1985 levels of 30 million tons per year, the sources said.

Under such contracts, the price paid by foreign buyers is based on an average of world prices at the time of the sale. "It's a buyers' market now. The Chinese have no choice if they want to continue exporting," said one industry analyst.

Chinese officials have also said they will offer more attractive terms to foreign companies prepared to invest in exploration and development of China's on and offshore reserves.

Sources close to the industry said China was to scrap existing bidding procedures for exploration and development rights in the South China Sea, replacing them with direct negotiations favoured by foreign firms.

But analysts warned that even with drastically reduced taxes and special inducements, most of China's yet-to-be developed reserves would be uneconomical at current world prices.

Chinese Petroleum Minister Wang Tao, who spoke with Hong Kong reporters along with Mr Zheng last week, said 50 foreign companies sent delegations to discuss onshore cooperation after it was announced last February that South China would be opened to foreign exploration and development.

All but one--Australia's CSR Orient Petroleum, which is searching for oil on South China's relatively accessible Hainan Island--have since withdrawn from discussion of onshore exploration, he said.

Mr Wang said that despite the price fall, China would push ahead with plans to boost annual production from 125 million tons in 1985 to 150 million tons by 1990.

"Development of our petroleum industry isn't reliant on exports," Mr Wang said. "Overall, we have yet to catch up with the development of the country's economy."

Chronic energy shortages are a major bottleneck in the economy, and energy demand is expected to soar as urban reforms take hold and the country's industries gear up for a major export push, analysts said.

Industry sources said some foreign exploration and service companies were looking to the relative stability of China's planned petroleum sector to help tide them over the worldwide slump.

Mr Wang said cooperation with foreign energy firms in such fields as personnel training, equipment purchases and technology transfer would be expanded regardless of the drop in foreign investment in China's industry.

Foreign firms had invested 1.6 billion dollars in China's petroleum sector since the first contracts for offshore exploration came into effect in 1982, he added.

China's own investment, much of it for purchase of foreign technology and equipment, has totalled 1.8 billion dollars over the past 5 years, most of it in the past 2 years, Mr Wang said.

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OIL AND GAS

NANHAI SPEEDS UP DEVELOPMENT OF NATURAL GAS

Hong Kong TA-KUNG-PAO in Chinese 13 Feb 86 p 1

[Text] According to the Ministry of Petroleum Industry, the feasibility study for the construction of Nanhai natural gas pipeline has essentially been completed and detailed surveys are currently underway.

A ministry official said that the Nanhai natural gas pipeline is part of a comprehensive natural gas development in Nanhai and the project has become part of the 7th FYP.

The field currently under development is the Ya-1 gas field. This is the first natural gas field developed since the joint venture to develop the offshore oil and gas resources began. It is being developed by the China Petroleum General Company, and Alcoa and Santa Fe in the United States.

Based on figures provided by the Ministry of Petroleum Industry, the gas field will begin production on 1 July 1989. It will provide 3.25 billion cubic meters of natural gas per year at its peak production period and will produce gas steadily for 20 years.

The ministry official said that 1330 kilometers of natural gas pipelines, including the trunk line and branches, will be needed to utilize the Nanhai natural gas.

Based on the current design plan, the trunk line will run from Nanshan in Hainan to Guangzhou, via Haikou, Zhanjiang, Maoming and Foshan, and then from Guangzhou to Shenzhen. A branch line will run from Heshan to Zhuhain via Zhongshan.

The general plan of the project will be made after the new year and the bidding and basic design will be completed in the second half of 1986. In the meantime, the ministry will sign natural gas sales contracts with the countries and cities along the pipeline by the end of this year.

It was revealed that the short term customers will be the counties, cities, townships and major enterprises along the pipeline and the natural gas will be used for civilian and industrial purposes. Today the counties and cities have established offices to build small supply networks in the area.

In recent years the rate of economic development in Guangdong far exceeded the growth of raw material and fuel. Due to the shortage of fuel, only 7 percent of the users in large and medium cities have access to gaseous fuel, far below the national average of 22 percent.

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CSO: 4013/91

ZHONGYUAN DEVELOPMENT, PRODUCTION TIED TO ADVANCED TECHNOLOGY

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 12 Mar 86 p 3

[Text] In the 3 years since the State Council issued its decision to accelerate the exploration and development of the Zhongyan oil field, the field has completed early or surpassed the production and construction as well as the scientific and technical tasks assigned it in the original plan.

Recently, statistical material presented at a science and technology forum held at the oil field demonstrated that in the last 3 years Zhongyuan has verified petroleum geological reserves of 300 million tons and natural gas geological reserves of 25 billion cubic meters. At the same time, with technological breakthroughs in such areas as comprehensive geological studies, seismic exploration, well logging, slurries, well drilling, oil field development, surface collection and transmission, etc., grasped and applied in varying degrees current advanced and new technologies, some of which surpass advanced world levels reached in the late 1970s and early 1980s.

In oil field construction, Zhongyuan has already built five fields--Puyang, Wenzhong, Weicheng, Wenmingzhai, and Wennan--built roads to Loyang, Kaifeng, Anyang, and Tangyin, and laid oil and gas pipelines to Cangzhou in Hebei Province.

In 1985 the Zhongyuan fields produced 5.5 million tons of crude to place it fifth in the nation in volume of crude produced. The oil and natural gas resources here are very abundant but the geological conditions are somewhat complex and the drilling difficult, requiring more advanced technology.

Since April 1983, the Zhongyuan oil field has, with the cooperation of more than 50 units from around the country, established a technology coordination network. According to incomplete figures, more than 600 experts, professors, and technical personnel have joined this oil field S&T effort, solving more than 800 problems. More than 500 achievements in science and technology are to their credit, resulting in some 160 million yuan in economic benefit.

Since 1982, the Zhongyuan oil field has imported from the United States, France, the Federal Republic of Germany, and other countries advanced seismic exploration, well logging, and slurry [mud] technologies and has made use of foreign technicians.

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CSO: 4013/103

PROSPECTS FOR CHINA'S NATURAL GAS RESOURCES DISCUSSED

Beijing SHIYOU KANTAN YU KAIFA [PETROLEUM EXPLORATION AND DEVELOPMENT] in Chinese Vol 12, No 6, 1985 pp 72-80

[Article by Zhang Wenzhao [1728 2429 2507] of the Department of Exploration, Ministry of Petroleum Industry: "China's Natural Gas Prospects and Measures That Should Be Adopted in the Future"]

[Text] Abstract

China is rich in natural gas. It has many large continental facies basins, many coal-bearing strata, enormous coal reserves and deep basin subsidence on a large scale. Moreover, it has the geological conditions for the formation of large gas pools. The recent situation in exploration for natural gas is very good and there have been many new discoveries that prove China's richness in natural gas resources and show the broad prospects for exploration. Predictions are that favorable gas-bearing regions may be found in the North China Basin, the Shaanxi-Gansu-Ningxia Basin, the southeastern Songliao Basin, the southern Liaohe Depression extending to Liaodong Gulf, the Yingge Hai Basin and other areas. There have been weak links in natural gas exploration in the past and we should develop specialized exploration for natural gas in the future in a planned and step-by-step manner. I am confident that a high tide of natural gas exploration will appear in the future and will open up a new situation in the natural gas industry.

Preface

The world's natural gas output has grown very quickly since the 1970's and estimates are that the peak of natural gas output will arrive during the early part of the 21st century. China's regional geological conditions indicate that it is rich in natural gas, but exploration for natural gas in China remains at a low level. There are very few specialized natural gas exploration and scientific research staffs, exploration techniques and methods are ill-adapted, and some policies have not been implemented, all of which has caused the development of natural gas to remain far behind international levels. This article will analyze the geological conditions and resources of natural gas in China and attempt to suggest some measures related to the direction that should be taken in natural gas exploration.

I. World Trends in Natural Gas Development and the Current Situation in China

World petroleum output has grown slowly since the 1970's but natural gas has grown at a high rate. Between 1970 and 1983, annual output of natural gas grew from 1 trillion cubic meters to 1.558 trillion cubic meters, a 55.8 percent increase. This is especially true of the Soviet Union, where it grew from 197.9 billion cubic meters to 534.96 billion cubic meters, a 1.7-fold increase. The situation in other large gas-producing countries is the same, with a 1.4-fold increase in Holland, 2.3-fold in Mexico, 2.6-fold in England, and so on. Predictions are that the peak in world gas output will come during the early part of the 21st century (see Figures 1 and 2). World natural gas reserves have grown even more quickly. Between 1970 and 1983, surplus extractable petroleum reserves rose from 73.99 billion tons to 91.68 billion tons, a 24 percent increase, while natural gas reserves increased from 41.6 trillion cubic meters to 90.6 trillion cubic meters, a 118 percent increase. This has made the oil-gas ratio in energy roughly equal, 1:1 for reserves and 1.7:1 for output.

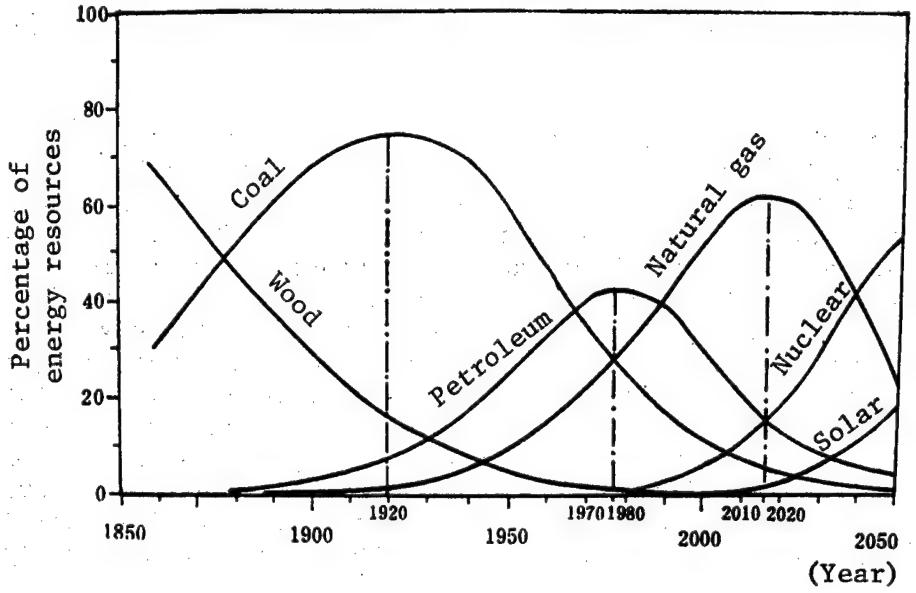

Figure 1. World Trends in Primary Energy Resource Substitution (Source: C. Marchetti, "Evolution of Energy Resource Systems and a Theoretical Model of Substitution," 1979)

China has seen more than 30 years of natural gas exploration and development, and reserves and output both have taken a major step forward. The current oil-gas energy ratio, however, is 13:1 for reserves and 8:1 for output. Natural gas accounts for only 2.4 percent of the energy resource structure, so the degree of exploration obviously is low. Although the amount of proven reserves in gas strata at present is small, their regional distribution and geological period of gas production indicate that they are rather widespread.

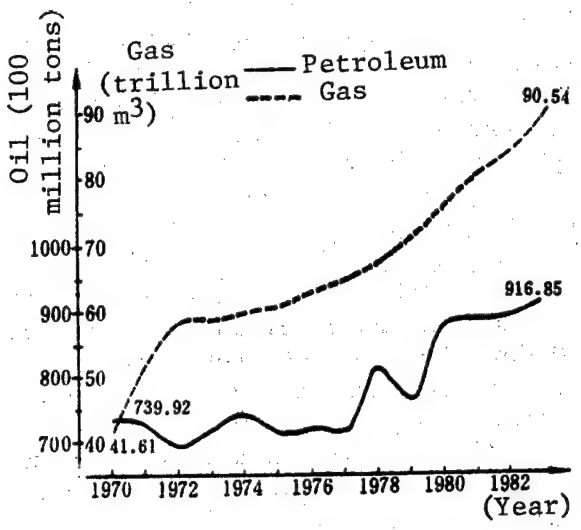

Figure 2. Growth Curve of World Oil and Gas Reserves Since the 1970's

The regional distribution is such that the southwest accounts for 61 percent, mainly in Sichuan and a small amount in Guizhou. East China accounts for 34 percent, distributed across the Liaohe, Zhongyuan, and Dagang [fields]. New discoveries have been made in the Central Hebei Depression in recent years and reserves have grown. The west accounts for only 5 percent of natural gas reserves, distributed in the Qaidam and Junggar basins. Discoveries of gas pools in the near future in southern Xinjiang at Kokyar and the northern Tarim Basin will lead to significant increases in reserves in the west.

The geological periods of gas production show that natural gas pools have been found in nine geological periods from the Quaternary to the Sinian. The gas strata in the Sebei 1 and 2 salt lake gas pools in the Qaidam Basin are buried at only a few tens to 1,000 or more meters. Shallow, low-output natural gas strata have been found in the middle and lower reaches of the Chang Jiang and along the coast.

The Tertiary is an important gas-bearing strata system with 28 percent of reserves and can be found throughout the basins of east China. The recent discoveries of the Kokyar oil and gas pool in Xinjiang's Tarim Basin and the Ya 13-1 gas pool in the Yingge Hai Basin have caused reserves in Tertiary gas strata to exceed those of other periods significantly and move into first place. The gas pools in the Taiwan Basin also were produced in the Tertiary system.

Cretaceous and Jurassic reserves are very small. The Cretaceous system is distributed mainly in the Songliao Basin and the Jurassic is found mainly in the Sichuan Basin.

The Triassic accounts for 21.9 percent of China's reserves and is second only to the Tertiary in its importance as a gas-bearing strata system. It is distributed mainly in marine facies Jialing Jiang suite carbonatite in Sichuan and in gas pools in continental facies sandstone in the Shaanxi-Gansu-Ningxia and Junggar basins.

The Permian is another important gas-bearing strata system and accounts for 16 percent of China's reserves, third place. It is found in marine facies carbonate rock in Sichuan. The Guanji Well in Sichuan, China's deepest gas well, is a Permian system gas pool at 7,053.5 to 7,175 meters. The recent discoveries of gas pools at Suqiao in north China and in the Shihezi suite in the Shaanxi-Gansu-Ningxia Basin will lead to a substantial rise in reserves in the Permian.

Carboniferous system gas pools are found mainly in dolomitic rock and limestone in eastern Sichuan and western Hubei and account for 15 percent of China's reserves. The Ordovician accounts for very few reserves. The discovery of the Suqiao, Guxinzhuang and Liuqiying gas pools in north China has added a gas-bearing strata system in eastern China. In addition, industrial gas flows have been obtained from Ordovician limestone in mountain structures at Longnusi in central Sichuan and in southeastern Sichuan.

The Sinian system is the oldest gas-bearing strata system in China. Natural gas was produced in the Weiyuan gas pool in Sichuan. The geological reserves arranged according to the distribution of geological strata positions are shown in Table 1.

Table 1. Distribution of China's Natural Gas Geological Reserves by Era

	Quaternary	Tertiary	Cretaceous	Jurassic	Triassic	Permian	Carboniferous	Ordovician	Sinian
Proportion of total reserves in China (percent)	2.8	28	1.7	0.3	21.9	16	15	1.3	13

An examination of the causes of natural gas formation indicates that the natural gas pools that have been discovered and proven to date fall mainly into the categories of oil and gas pool and carbonate rock overly-mature gas, which account for 32.8 percent and 58.4 percent of China's natural gas reserves, respectively. The former was cogenetic with petroliferous regions in east and west China, while the latter occurs in Paleozoic and Mesozoic carbonate rock strata in Sichuan and Guizhou. The low degree of exploration for coal-produced gas in China means that only some gas pools in the Triassic Xujia He suite (Xiangxi suite) in Sichuan and the Wen-23 gas pool in the Dongpu Depression have been proven to date. They account for only a small proportion of China's total reserves. The recent discovery of coal-formed gas pools at Suqiao in north China, on the western margin of the Shaanxi-Gansu-Ningxia Basin and in the Lishu-Dehui Depression in the southeastern part of the Songliao Basin will raise the proportion of coal-formed gas significantly. Proven reserves of shallow strata organic gas account for only 2.8 percent of China's total reserves and are found mainly in the eastern part of the Qaidam Basin, while there have also been discoveries in the Mingshui suite in the southern part of the Songliao Basin and in the lower reaches of the Chang Jiang.

II. An Analysis of the Potential for Natural Gas Resources

The level of exploration and research for natural gas in China is very low, but an analysis of geological conditions indicates that China is extremely rich in natural gas resources and that it has the conditions for the formation of large gas pools.

1. There are many large continental facies basins and large sedimentary rock accumulations.

It is well known throughout the world that continental facies are rich in gas. Practice has proven that most large gas pools in the world were produced in continental facies. Examples include the enormous gas-bearing region in western Siberia and the especially large Groningen gas pool along the shore of the North Sea. According to statistics from B.C. (Weishemiersiji) in the Soviet Union, continental facies account for 41 percent of the world's gas pool reserves while marine facies account for only 16 percent. The remainder is found in shallow water, coastal and transitional facies. Sandstone contains 76 percent of the world's natural gas reserves, while carbonate rock and other rock accounts for only 24 percent. China's continental facies sediments are world-famous, with 10 basins greater than 100,000 square kilometers in area and a total area of 2.3 million square kilometers. They include the Tarim, Shaanxi-Gansu-Ningxia, Songliao, North China, Sichuan, Junggar, Qaidam, Erlian, Donghai, Zhujiangkou [Pearl River Mouth], and other basins. China has one of the largest numbers of large continental facies basins among the nations of the world. The Chinese continent has 4.24 million square kilometers of sedimentary rock and 1.30 million square kilometers of continental shelf. The total volume of sedimentary rock is 22 million cubic meters. China stands at the forefront in natural gas geological conditions compared with the 12 large gas-producing countries of the world, second only to the Soviet Union and about the same as the United States. China's continental facies sediments, however, are more developed than in the United States, the area of continental basins is larger and they extend over longer periods. All of these exceed the United States (the largest continental facies lake basin watershed in the United States is 130,000 square kilometers and was sustained over a period of 3 to 13 million years, while China has many basins covering several 100,000 square kilometers that were sustained over a period of 40 to 50 million years).

2. There are many coal system strata that are widely distributed and contain large coal reserves.

Research over the past several decades throughout the world has proven that coal systems and natural gas are closely related. A large coal content means a large natural gas content. The Eurasian continent has large coal reserves and large natural gas reserves (the Eurasian continent accounts for 60 percent of the world's coal reserves and 83 percent of natural gas reserves). The Soviet Union and the United States are among the countries with the largest coal reserves and they hold first and second place respectively in natural gas output in the world. A preliminary investigation indicates that coal-formed gas reserves account for 50 to 70 percent of total natural gas reserves

in the world (65 percent in the Soviet Union and 93 percent in West Germany). Many of the world's largest gas pools are coal-formed gas pools. China has the largest coal reserves in the world. According to statistics, the coal-bearing area covers at least 1 million square kilometers and seven coal accumulation periods extend from the Tertiary to the Carboniferous. Proven reserves are 700 billion tons and resources add up to several trillion tons. According to incomplete estimates from experts in various units made in recent years, China has 2.8 to 20 trillion cubic meters in coal-formed gas reserves.

3. China has deeply subsided petroliferous basins of great extent that are conducive to the formation of deep strata splitting gas.

When considered in terms of their shape, the basins of the world come in two classes. One type is large and flat, like the West Siberia Basin in the Soviet Union that covers an area of 3.2 million square kilometers and has a width to depth ratio of 160:1. The other type is narrow and deep, like the Liaohe Depression, which has a width to depth ratio of 2.5:1. The first type of basin is conducive to coal-formed gas and the formation of gas for organic reasons. The latter type is extremely favorable to the formation of deep strata splitting gas. Many of the basins in China's eastern and coastal regions are of the second category (rift valley type fault subsidence basins) and the degree of subsidence exceeds 10,000 meters. China has 20 large basins (basins larger than 10,000 square kilometers) and the depth of the sedimentary rock exceeds 6,000 meters. An analysis of the concepts of the phases and zonality of thermal evolution of the organic rock indicates that at least one-half produced oil and one-half produced gas (at 4,000 to 8,000 meters). The range of deep strata gas still has not been revealed. China has 1.63 million square kilometers of overly-mature sedimentary rock areas but the degree of exploration is very low. Only 316 exploratory wells had been drilled more than 4,000 meters deep in China up to 1983, only 1.5 percent of all exploratory wells. This shows the great potential for natural gas in deep strata.

4. China has the geological conditions for formation of large gas pools.

If we analyze the geological conditions of large gas pool formation throughout the world, there are four basic characteristics: The first is that large basins have sufficient gas sources. The second is that they have enormously thick and stable capping strata and preservation conditions. The third is that they have large anticlinal traps (anticlinal trap gas pools account for 92 percent of total world reserves). The fourth is that they have rather good reservoir strata (reservoir strata conditions are not strict, however). As for China, the first, second and third characteristics basically indicate the presence of large basins and sufficient gas sources. As for the capping strata question, all of China's fault and subsidence basins have enormously thick mudstone in continuous accumulations of 200 to 800 meters, and they also have enormously thick gaoyan strata distributed over a wide area. There also are many large anticlines with a moderate degree of deformation. As for the quality of natural gas reservoir strata, the porosity of the world's largest gas pools generally is 10 to 20 percent. The porosity of the Panhandle-Hugoton gas pool in the United States, for example, is only 10 to

15 percent and the permeability is 1 to 5 milliDarcys (see Table 2). The quality of gas pools and gas-bearing structure reservoir strata discovered recently in China basically meet these conditions (see Table 3).

III. Forecasts for China's Favorable Gas-Bearing Regions

The Sichuan Basin is China's known gas-bearing region and has rich natural gas resources. Besides the Sichuan Basin, an analysis of geological conditions in combination with recent natural gas exploration results indicates that China has seven hopeful gas-bearing regions. The degree of natural gas exploration in these regions is very low but the prospects are extremely bright.

1. The North China Basin

The key area is the Suqiao--Yangcun slope. The Carboniferous and Permian systems are well-preserved here and occur over an area of 6,800 square kilometers. A series of reverse normal faults that have developed in the slope zone form excellent fault-block buried hill traps on the slope. The Permian and Ordovician system reservoir strata, such as coarse grained Permian sandstone, are of good quality. Analysis of cores from the Su-20 well shows an average porosity of 16.3 percent and permeability of 227 milliDarcys, forming favorable conditions for high output. The discovery of coal-formed gas in the Carboniferous, Permian and Ordovician systems at Suqiao proves that there is an enormous scope for exploration in this region. Moreover, the Zhoukou Depression in the southern part of the North China Basin also is a prospective gas-bearing region and should receive attention.

2. The Shaanxi-Gansu-Ningxia Basin

This is a deeply-buried coal accumulating basin that has been preserved intact. The Carboniferous-Permian coal strata and scattered organic matter accumulations are extremely rich and predicted coal-formed gas resources are 2 to 4 trillion cubic meters. This gives this basin a duality of being an oil-bearing and gas-bearing basin. The Triassic and Jurassic systems in the upper part contain mostly oil while the Carboniferous and Permian systems in the lower part contain mostly coal and coal-formed gas. Many sites of industrial gas flows have been encountered in the area of Liujiazhuang and Shenglijing at the western margin of the basin and on the northern margin. Widespread gas seepages also have been found along the eastern margin. Further exploration will make new breakthroughs certain and the short-term focus should be placed on Hengshanbao and Majiatan at the western margin of the basin and in a zone running north and south along the Tianchi structure to prepare for exploratory drilling in the well-preserved anticlines.

3. The Southeastern Part of the Songliao Basin

The Songliao Basin has a geological structure that is fractured below and subsided above and geological characteristics of gas below and oil above. The depth of the oil generation window in the Songliao Basin is shallow (only 1,200 meters) and the main zone of oil formation is 1,200 to 2,600

Table 2. Statistics on the Qualities of the World's Largest Gas Fields

Name of gas field	Extractable reserves (trillion m^3)	Strata and lithology	Depth of burial (meters)	Porosity (percent)	Permeability (milliDarcys)	Explanation
Urengoy (West Siberia, USSR)	7.77	Cretaceous, sandstone	1,100-3,550	11-21 (usually)	43-116	Maximum porosity in this gas field is 27 percent and maximum permeability is 459 milliDarcys. It is in shallow strata of the Sainuoman member (K_2).
Yamburg, West Siberia, USSR	4.0	Cretaceous, sandstone	1,004-3,177	15-18 (usually)	15-18	Maximum porosity in this gas field is 27 percent and maximum permeability is 470 milliDarcys. It is in the Sainuoman member (K_2).
Groningen, Holland	2.5	Lower Permian suite, sandstone	2,896	15-20	115	
Panhandle-Hugoton	2.0	Permian system limestone and sandstone	1,250-1,920	1-5	1-5	
Orenburg (USSR)	1.6	Cretaceous, sandstone	1,500-1,700	11.3-12	0.1-870	
Hassi-Lallemand, Algeria	1.53	Triassic, medium fine sandstone	2,137-2,275	16	30-500	

Table 3. Qualities of Reservoir Strata in Recently Discovered Gas Pools (or Gas-Bearing Structures) in China

Region	Gas field (or gas-bearing structure)	Strata	Lithology	Depth of burial (meters)	Qualities		Notes
					Porosity (percent)	Permeability (percent)	
Western margin Shaanxi-Gansu-Ningxia	Shengli well	Shihezi suite, Lower Permian	Sandstone	2,354-2,550	12.9	2.5-15.8	--
Northern margin Shaanxi-Gansu-Ningxia	Yi-shen 1 well	Shihezi suite, Lower Permian	Sandstone	--	25	371	Yishen-1 well core
North China	Suqiao	Shihezi suite, Lower Permian	--	3,342-3,392	Averages 16.3 (13.6-19.2)	227 (79-104)	Su-20 well core
Jilin	Lishu, Yashan structures	Quan 1 member, Cretaceous	Sandstone	1,468-1,473	15.5	68.8	Average values for 11 cores from Lican-1 well
Jilin	Nong'an	Quan 1, 3 members, Cretaceous	Medium coarse sandstone	800-1,400	11.7	10.08	158 samples
Dongpu	Wen 23 fault block	Sha 4 member, Lower Triassic Tertiary	Fine sandstone	2,995-3,011	11.9	2.1	88 samples from Wen-61 well
Dongpu	Baimiao	Sha 2, 3 members, Lower Tertiary	Sandstone	3,064-3,401	14-18	100-200	Bai-10
Yingge Hai	Ya 13-1	Lower Tertiary Triassic	Sandstone	3,708-3,907	Averages 15.1	-	--

meters. When combined with the fact that Jurassic coal system strata developed mainly in the fault-subsidence in the lower parts and that they are mainly humic casein base, the result is that strata in the lower parts of the Songliao Basin are mainly areas of natural gas. In the past, we found the Daqing, Fuyu and other oil pools in the Cretaceous subsidence in the upper parts, and the degree of exploration is rather high. Our knowledge of the Jurassic fault-block basin in the lower parts is inadequate, however, and the degree of exploration is very low. Industrial gas flows (coal-formed gas and CO_2 gas) were discovered recently at Lishu, Nong'an, Wanjinta and other sites in the Lishu-Dehui Depression in the southeast part of the basin, and it has been confirmed that the gas source was the Jurassic system. Besides the gas pools that were generated and reservoired in the Jurassic system itself, the large anticlines and basement buried hills in the lower part of the Cretaceous (the Quantou suite) are extremely favorable gas-bearing traps. This is a new realm of exploration in the Songliao Basin and should receive adequate attention.

4. The Southern Segment of the Liaohe Depression--Liaodong Gulf

This region is one of maximum downwarp and subsidence. The oil generating rock is very thick and buried at more than 8,000 meters. This is extremely favorable for the formation of deep strata splitting gas (currently proven reserves of gas in gas strata here are second only to Sichuan in China). The region has many fractures and anticlines, excellent entrapment and preservation conditions and good quality reservoir strata, so there is hope that high output petroliferous regions (mainly gas) may have formed. The results of recent exploration indicate that there is a gradual increase in gas pools in the Liaohe Depression moving from north to south. Gas in gas-bearing strata and gas atop gas are extremely developed in the Shuangtaizi, Shuangnan, Rongxingtun and other structures near Liaodong Gulf. High output gas flows have erupted from the Liao-1 and Jinzhou 20-2-1 wells during exploratory drilling in the Liaodong Gulf, so there is hope of finding large gas pools here with additional exploration.

5. Deep Strata in the Dongpu Depression

The Dongpu Depression is one of China's most deeply subsided fault-subsidence basins. The organic rock in the depression is buried at about 10,000 meters and the amount of gas reserves in gas-bearing strata proven to date is third greatest in China. The geological conditions of the region indicate that the Tertiary Sha-4 member below the deep strata in the Dongpu Depression have regional distributions of enormous 500-to-800-meter-thick gaoyan strata. Widely distributed strata of Permian coal-bearing rock systems are preserved intact in the lower parts of the depression. This is favorable to the formation of coal-formed gas and deep strata splitting gas, and it also has excellent capping strata preservation conditions, so this is hopeful site for gas-bearing areas in deep strata. The Wen-23 fault-block dry gas pool below the salt in the deep strata was found during practice in exploration and the Baimiao gas pool was discovered. Industrial gas flows have been encountered in the southern part in deep strata at Qiaokou and Machan, and exploration for natural gas is quite up to date here. It deserves mention that it is

hard to discern the structures below the Sha-4 salt. The reservoir strata are rather dense and require stronger research on deep strata structures and attention to exploratory drilling and gas extraction technologies before a new situation of gas exploration in deep strata can be created.

6. The Yingge Hai Basin

This basin is an extension of the Hong He Rift Valley. Enormously thick Tertiary organic rock developed here and there are many coal bed suites of humic organic rock that are extremely conducive to the formation of coal-formed gas and deep strata splitting gas. Anticlinal structures have developed in the middle of the basin and they are fully formed. There are excellent and stable mudstone capping strata conditions, so it has superior conditions for the formation of large gas pools. High output gas flows have been encountered from two exploratory wells in the Ya 31-1 structure. The gas strata are thick and the traps cover large areas, so preliminary estimates are that reserves there make it one of the largest gas pools in China at present. A cluster of anticlinal structures has developed to the south of the gas pool and the Ledong 30-1 well has been drilled 3,200 to 3,920 meters into deep strata. During the exploratory drilling, two suites of high pressure gas strata also were encountered, so there is hope that additional exploration will lead to the discovery of a high output gas-bearing region.

7. The East China Sea Basin

The East China Sea Basin covers an area of 250,000 square kilometers and is a predominantly Tertiary continental facies sedimentary region. The maximum degree of subsidence in the basin exceeds 10,000 meters and the organic matter is terrigenous sapropelic and humic in quality, slightly more humic, so it is a very hopeful oil and gas (mainly gas) basin. The Pinghu 1 Well provided the first discovery of oil and gas. Two suites of high output gas strata were found in the Tertiary at a depth of 2,972 to 3,618 meters. Analysis of geological conditions indicates that the Xihu and Wendong Depressions in the East China Sea Basin are the most hopeful regions. The area has many anticlinal traps and they cover wide areas, the Yuquan structure at 850 square kilometers, for example. The most notable is the roughly 10,000 square kilometer triangular region between Pinghu, Yuquan, and Chunzhao (known as the Golden Triangle), which is the most prospective area.

Natural gas exploration must be reinforced in these seven regions and specialized natural gas exploration should be developed gradually and in a planned manner. In addition to these, the Chuxiong Basin, the Qinshui Basin in Shanxi and the northern Tarim Basin are very hopeful regions for gas-bearing prospects. The most beneficial is exploration for coal-formed gas. Seismic studies and selection of parameter wells for exploratory drilling should begin as soon as possible.

IV. Weak Links in Natural Gas Exploration and Measures To Adopt

Combined exploration for oil and gas is one of the major problems in natural gas exploration. The formational categories and conditions of gas pools are

quite different from those of oil pools. There are six major differences: 1) In formational categories, natural gas involves thermal metamorphosis of organic rock and exhibits obvious phases and zonality. Petroleum is produced in a limited fashion, and there is a primary oil generation zone usually found at 2,000 to 4,000 meters. Natural gas is much more widespread, from several tens of meters to 8,000 meters (the world's deepest gas well is located in the United States' western interior basin at a depth of 8,088 meters). Organic gas can be produced in shallow strata, strata at moderate depths can produce oil-pool gas and oil-associated gas, deep strata (below 4,000 meters) are conducive to the formation of deep strata splitting gas, and even deeper it is possible that inorganic deep strata gas may have formed. In addition, we also can search for coal-formed gas, water soluble gas pools and non-hydrocarbon gas pools (like carbon dioxide, hydrogen sulfide, helium gas and other useful gases), so the spheres of gas exploration are much broader than for petroleum. 2) Natural gas undergoes percolation and diffusion. Its migration is more energetic than petroleum and it is distributed more widely. 3) Natural gas places lower demands on reservoir strata quality and we can say that there "are no pores where it cannot go." Porosity of 10 to 15 percent and permeability of 1 to 5 milliDarcys are sufficient for the formation of especially large gas pools, so the demands are much lower than for oil generation. 4) Natural gas has high demands for capping strata and preservation conditions. The formation of large gas pools requires rather thick and stable mudstone or gaoyan strata to serve as capping strata. 5) Most petroleum is produced in marine facies sediments while most natural gas is formed in continental facies sediments. The parent material of oil generation is mainly sapropelic casein base, while the parent material for natural gas generation is mainly humic casein base. 6) Coal seams and coal system strata are not linked closely with the generation of petroleum but they are an important realm of natural gas formation (coal-formed gas). All of these factors mean that many of the world's large gas pools exist independently and there are some independent gas-bearing basins as well. Statistics indicate that 90 percent of the world's natural gas reserves are separated from petroleum. In the famous petroliferous West Siberia Basin in the Soviet Union, there is a large oil region in the south and a large gas region in the north. In the North Sea Basin in Western Europe, the northern and central parts are an oil region while the south is a gas region. Another example is Romania's Transylvania Basin where independent gas-bearing basins formed, and so on. If we search for natural gas using the concept of joint exploration for oil and gas, we will miss large gas pools or gas regions. We should, therefore, establish special staffs for natural gas exploration and development.

The methods used in exploration for natural gas and scientific research should be adapted to the characteristics of natural gas and they should be different from those used for petroleum. Natural gas is invisible and untouchable. Logging wells leak easily and loggings have a low rate of successful interpretation. There are many regions where no logging wells have been drilled and no logging wells have been bored into deep strata. One deep--one shallow: this is the range of gas strata distribution and gas strata are easily missed. Logging, gas measurement, fluorescent and intermediate testing and other work must be done meticulously and at a high

level before they will be successful. Seismic and logging work should deal directly with the characteristics of gas to study a group of field and laboratory interpretation methods. In scientific research, work on geology, development, exploratory drilling, gas extraction and even collection and transport technologies should be developed according to the characteristics of natural gas.

The limited investments and amount of work done in exploration for natural gas are another weak link. The state has focused on the key question of coal-formed gas in the past few years but the amount of exploration done still is too little. Specialized exploratory drilling for coal-formed gas in China in 1984 accounted for only 2.5 percent of the amount of exploratory drilling done.

The 3d Plenum of the 12th CPC Central Committee pointed out that reforms are an urgent requirement in the development of China's situation at the present time. We also should use the spirit of reform to promote natural gas exploration and development work, and we should deal with problems that obstruct and affect any aspect of reforms in natural gas exploration and development.

First, natural gas price policies must be implemented. The 3d Plenum of the 12th CPC Central Committee pointed out clearly that we should establish a rational price system and pay full attention to the role of economic levers. Natural gas prices in China are irrational. Not only are they lower than on the international market, but they also are low in comparison to other energy resources within China. This has had great effects on enthusiasm for natural gas exploration and development. Natural gas reserves and output should be converted to equivalent amounts of petroleum to calculate the economic benefits of exploration and development. Second, we must improve natural gas exploration techniques and methods and strengthen logging work, and all exploratory wells should be outfitted with high precision gas meters to begin at the well mouth when carrying out gas measurement and logging work. Intermediate tests should be frequent and should be done whenever gas indications, well surges, leakages, cavities, or other things are encountered during exploratory drilling and no questionable stratum should be missed. We should perfect logging systems and suture logging systems for natural gas exploration and use logging effectively to find gas strata. Seismic work should be adapted to the needs of gas exploration and improve on-site and laboratory interpretation methods. We should improve the level of drilling inclined wells and clustered wells to raise the success rate in exploratory drilling and single well output. Third, scientific research work should deal directly with the characteristics of natural gas and select good scientific research topics to formulate regulations for natural gas exploration and development and for resource evaluation and calculation of reserves. I propose that China establish an Institute of Natural Gas and that every oil field set up a natural gas research office.

In summary, China is rich in natural gas resources and the prospects are bright. We must place importance on strategies and have full confidence. Our tactics should deal directly with the characteristics of natural gas and involve a set of technical methods and measures. We certainly will be able

to find large high-output gas pools in the near future and make a contribution to the four modernizations drive.

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12539/6091
CSO: 4013/73

SICHUAN'S NATURAL GAS ACCOUNTS FOR OVER ONE-HALF NATION'S TOTAL

Beijing RENMIN RIBAO (OVERSEAS EDITION) In Chinese 18 Dec 85 p 3

[Article by XINHUA reporters Mi Lirong [4717 7787 5554] and Chen Yongfang [7115 3057 5364]]

[Text] The reporters have learned from the Sichuan Provincial Planning and Economic Commission that the province's total primary energy output [in 1985] will be equivalent to over 48.9 million tons of standard coal, a more than 5.5 percent increase over [1984].

Natural gas output, an important part of Sichuan's energy production, had already topped 5.07 billion cubic meters as of the end of November, fulfilling 101 percent of the state plan for the whole year. Sichuan is China's major natural gas production base. Its gas fields account for more than one-half the country's total nautral gas reserves and output.

Since the beginning of [1985], Sichuan's petroleum departments have carried out vigorous prospecting and exploitation in the eastern and northeastern parts of the province. They have found 5 new oil- and gas-bearing structures, 13 natural gas reserves and sites for 53 industrial gas wells which are worth developing, thus achieving a steady increase in natural gas reserves.

Statistics of the Sichuan Provincial Planning and Economic Commission also show that as of the end of November, the province had produced more than 49 million tons of coal, generated more than 20 billion kilowatt-hours of electricity and produced more than 108,000 tons of crude oil, an increase of 12.3 percent, 11.3 percent and 4.1 percent respectively over the same period a year before.

Small coal mines and small hydroelectric power stations operated by counties and rural villages in the province have also grown rapidly this year. The small coal mines now account for 63 percent of the province's total coal output. The installed capacity of the small hydroelectric power stations has increased by 60,000 kilowatts, making it possible for many mountain village residents to have electricity.

A responsible person of a concerned department maintained that the steady increase of energy output has created conditions for industrial production in the province to keep its increasing trend. As of the end of November, the province's total industrial output value had reached 41.056 billion yuan, fulfilling 97.2 percent of the whole year's plans and increasing by 17.2 percent over the same period of the previous year.

12802/12948
CSO: 4013/80

EXPLORATION CONFIRMS EXISTENCE OF 41 COAL-GAS FIELDS

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 25 Dec 85 p 1

[Text] According to JINGJI RIBAO [ECONOMIC DAILY] Report, departments under China's Ministry of Petroleum Industry have in the past 3 years verified 12 coal-gas fields (reserves), bringing the number of coal-gas fields (reserves) in the country to 41.

Coal-gas is a natural gas formed in coal seams. Of the natural gas reserves discovered so far in China, about one-third has been found in the last 3 years. Exploration of coal-gas fields has been a factor contributing to the marked increase in natural gas reserves.

China falls rather far behind the world level in the development of the natural gas industry. In 1978, Chinese scientific and technical workers imported and developed the new theory on coal-gas. In 1983, the state decided to include "coal-gas exploitation and research" as one of the 38 key scientific and technological research projects in the Sixth Five-Year Plan.

In the past 3 years, departments under the Ministry of Petroluem Industry have conducted coal-gas explorations and studies in eight major coal-bearing basins in China, and have discovered and confirmed a number of coal-gas fields and gas-bearing structures. These coal-gas fields include the largest known gas field in China located in the Qiongnan Basin and the Shenglijing and other gas fields in the Ordos Basin. The Suqiaopo gas field, discovered in the North China Basin, has been opened up and is providing natural gas for Beijing. In addition, coal-gas fields or gas-bearing formations have also been found in the Sichuan Basin, the Dongpu area and the Songliao Basin.

12802/12948
CSO: 4013/80

BRIEFS

1ST QUARTER '86 OUTPUT--Harbin, 7 Apr (XINHUA)--China's largest oil field, Daqing, produced 95,228,000 bbls in the first 3 months of this year, meeting the quarterly output quota. Daqing furnishes half of China's oil output. [Text] [Beijing XINHUA in English 1956 GMT 7 Apr 86 OW] /8309

BEIJING COAL NEEDS REDUCED--Shijiazhuang, 29 March (XINHUA)--New gas supplies from the Huabei oil field in north China will enable 60,000 Beijing households to replace their coal stoves with gas cookers this year. Officials here said today the first phase of a project to transfer the natural gas from the oil field to Beijing was completed by the end of last year. The designed capacity of the project' first phase is to provide Beijing with 400,000 cubic meters of gas a day, which will meet the needs of over 800,000 households in the capital city. Located in Beijing's neighboring Hebei Province, the Huabei oil field, China's third largest oil field after Daqing and Shengli, and claims to have verified reserves of 30 billion cubic meters of natural gas. Facilities to receive and burn the gas from the oil field are currently being constructed in Beijing, said the officials. The project will also help Beijing save coal and tackle its pollution, they said. [Text] [Beijing XINHUA in English 0700 GMT 29 Mar 86 OW] /12913

CSO: 4010/44

FRENCH, BRITISH SIGN NUCLEAR EQUIPMENT AGREEMENTS

OW191809 Beijing XINHUA in English 1610 GMT 19 Mar 86

[Text] Shenzhen, 19 Mar (XINHUA)--A letter of intent on the supply of two conventional nuclear islands (conventional power generating machines) by a British firm for a nuclear power plant in Guangdong Province was signed here today.

It was signed between the Guangdong Nuclear Power Joint Venture Co. (GNPJVC) and General Electric (GEC) of Britain for the Daya nuclear power plant, XINHUA has just learned.

The two conventional islands will each have a generating capacity of 900,000 kilowatts.

The signing of this and two previous documents ended the negotiations between GNPJVC and three foreign suppliers, a GNPJVC spokesman said.

Letters of intent on the supply of two reactors by two French firms, Framatome and EDF, were signed a week ago.

The companies involved will begin working in accordance with the three letters of intent as soon as the documents are approved by the governments of their countries, the spokesman said.

Construction is now in full swing on the infra-structure facilities for the plant, which will have two generating units with a capacity of 900,000 kilowatts for each, he added.

Bidding is now going on for the construction work of the plant itself, which is expected to begin in September. Participating in the bidding are French, British, American, Japanese and Hong Kong construction companies with Chinese companies as partners.

The first generating unit for the 3.7 billion U.S.-dollar Daya nuclear power plant should be in full commission in 1992.

/8309
CSO: 4010/42

NUCLEAR POWER

BRITISH SAID READY TO SIGN AGREEMENT ON DAYA BAY GENERATORS

HK050752 Hong Kong HONG KONG STANDARD (BUSINESS STANDARD Supplement) in English 5 Apr 86 p 1

[Text] The agreement for the supply of conventional turbine generators, by General Electric Co. [GEC] of Britain, for the Daya Bay nuclear power plant, will be signed in September.

GEC Director, Lord Nelson, said yesterday that all the major problems had been dealt with following the signing of the letter of intent last month with the Guangdong Nuclear Power Joint Venture Co. He said the negotiations had taken a long time because a number of questions had to be resolved, including the technical and financial arrangements. However, he declined to reveal the details of the financial arrangements, except to say that the contract is valued at more than $250 million.

He also does not foresee any technical problem in fulfilling the contract. He said that although the GEC had no experience in providing such large-scale turbine generators (for Daya Bay), there would be no technical difficulties because the model is the same as the one used in the Castle Peak power plant.

The contract represents a major triumph for GEC, and the British industry as a whole, as it is the largest single British export order to China.

Lord Nelson said it took 33 missions to China over a six year period before the contract was secured. It involved more than 4,000 man-days in China plus 3,000 man-weeks devoted to the project by personnel in Britain.

The Guangdong Nuclear Power Joint Venture Co has signed similar letters of intent, also last month, with the French company, Framatome SA, for the supply of two reactors, and with Electricite de France [EDF] for the engineering design of the plant.

The Daya Bay plant, located 70 km east of Shenzhen in Guangdong province, will be China's largest nuclear power station. The first generating unit is expected to come on-stream in 1992. The bulk of the electricity produced will be sold to Hong Kong with the remainder going to Guangdong.

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CSO: 4010/44

SUPPLEMENTAL SOURCES

IMPORTED GEOTHERMAL UNIT OPERATING IN XIZANG

OW250416 Beijing XINHUA in English 0250 GMT 25 Mar 86

[Text] Lhasa, 25 Mar (XINHUA)--A geothermal power generating unit with a capacity of 3,180 kW, has gone into trial operation at China's largest geothermal power station in the Tibet Autonomous Region.

The generator, manufactured jointly by companies in Japan and the United States, has brought the total capacity of the Yangbajing experimental power station, 90 kilometers northwest of Lhasa to 13,100 kW.

Some 30 of 600 places where geothermal resources have been found in Tibet are suitable for the installation of power generators totalling 800,000 kW.

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CSO: 4010/42

SUPPLEMENTAL SOURCES

TAIWAN-DEVELOPED BIOGAS DIGESTER TECHNOLOGY UTILIZED

OW141256 Beijing XINHUA in English 1212 GMT 14 Mar 86

[Text] Henyang, March 14 (XINHUA)--China is now able to industrialize and commercialize the technique of a red-mud plastic biogas digester developed in Taiwan, which is cheap and produces more gas than conventional pits.

Red-mud plastic is a new energy material developed by Taiwan Province in the 1970s. Composed of red-mud and polystyrene, it has ideal corrosion and ageing resistance, according to officials at the State Science and Technology Commission.

The digester, which has passed state technical appraisal, is simple in structure and uses solar energy to increase the fermentation temperature.

Japan, the United States and some other countries are also developing this facility to help solve rural energy shortages and improve environmental conditions, the officials said.

China, now pioneering production of gas by fermenting farmyard manure and human excrement, has been asked by an official of the United Nations Agriculture and Food Organization to help African countries build red-mud plastic digesters.

More than 48,000 such digesters are now in use in China, the State Science and Technology Commission officials said.

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CSO: 4010/43

BRIEFS

JIANGSU 6TH FYP CONSERVATION--Nanjing, 13 March (XINHUA)--According to statistics, the average annual increase of energy consumption in Jiangsu during the Sixth 5-Year Plan was 7.4 percent, while the increase in total industrial and agricultural output value was 15.2 percent. The energy conserved in the province during the 5 years amounted to more than 11 million metric tons of standard coal. During the period, Jiangsu completed 643 projects in energy-conserving technological transformation which saved 1.8 million metric tons of standard coal a year. [Summary] [Beijing XINHUA Domestic Service in Chinese 0014 GMT 13 Mar 86 OW] /12913

CSO: 4013/101

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